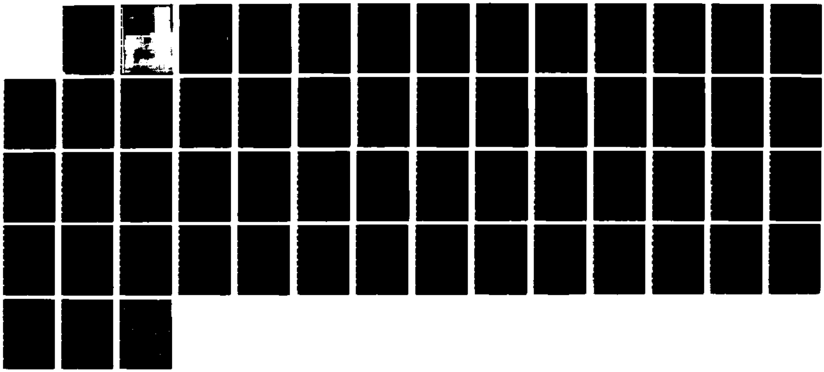
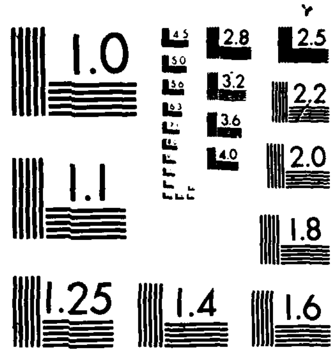
AD-A183 366 FULL-INFORMATION ITEM FACTOR ANALYSIS OF TEST FORMS 1/1
FROM THE ASVAB (ARMED (U) NATIONAL OPINION RESEARCH
CENTER CHICAGO IL M F ZIMOWSKI ET AL APR 87
UNCLASSIFIED MRC-87-1-REV N00044-85-C-0781 F/G 12/3 NL





MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

(12)

FULL-INFORMATION ITEM FACTOR ANALYSIS OF TEST FORMS FROM THE ASVAB CAT POOL

Michele F. Zimowski
National Opinion Research Center
and
R. Darrell Bock
University of Chicago

MRC Report #87-1 (Revised)

NORC

(12)

FULL-INFORMATION ITEM FACTOR ANALYSIS OF TEST FORMS FROM THE ASVAB CAT POOL

Michele F. Zimowski
National Opinion Research Center
and
R. Darrell Bock
University of Chicago

MRC Report #87-1 (Revised)

April, 1987
Methodology Research Center
1155 E. 60th Street
Chicago, Illinois 60637

This research was supported in part by Air Force Project #77191846, by the Office of Naval Research Contract #N00014-85-C-0781, and by National Science Foundation grant #BNS-8511774.

CLASSIFICATION OF THIS PAGE

ADA183366

REPORT DOCUMENTATION PAGE

1a. REPORT SECURITY CLASSIFICATION: Unclassified

1b. RESTRICTIVE MARKINGS

2a. SECURITY CLASSIFICATION AUTHORITY

2b. DECLASSIFICATION / DOWNGRADING SCHEDULE

3. DISTRIBUTION / AVAILABILITY OF REPORT: Approved for public release; distribution unlimited.

4. PERFORMING ORGANIZATION REPORT NUMBER(S): MRC Report #87-1

5. MONITORING ORGANIZATION REPORT NUMBER(S)

6a. NAME OF PERFORMING ORGANIZATION: NORC

6b. OFFICE SYMBOL *(If applicable)*

7a. NAME OF MONITORING ORGANIZATION: Personnel & Training Research Programs, Office of Naval Research (Code 1142PT)

6c. ADDRESS *(City, State, and ZIP Code)*: 1155 E. 60th, Chicago, IL 60637

7b. ADDRESS *(City, State, and ZIP Code)*: 800 N. Quincy St., Arlington, VA 22217-5000

8a. NAME OF FUNDING / SPONSORING ORGANIZATION

8b. OFFICE SYMBOL *(If applicable)*

9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER: N00014-85-C-0781

8c. ADDRESS *(City, State, and ZIP Code)*

10. SOURCE OF FUNDING NUMBERS

PROGRAM ELEMENT NO.	PROJECT NO	TASK NO	WORK UNIT ACCESSION NO
61153N	RR04206	RR04204-01	NR 150-541

11. TITLE *(Include Security Classification)*: Full-Information Item Factor Analysis of Test Forms from the ASVAB CAT Pool

12. PERSONAL AUTHOR(S): R. Darrell Bock and Michele F. Zimowski

13a. TYPE OF REPORT: FINAL

13b. TIME COVERED: FROM ______ TO ______

14. DATE OF REPORT *(Year, Month, Day)*: APRIL, 1987

15. PAGE COUNT: 51

16. SUPPLEMENTARY NOTATION

17. COSATI CODES		
FIELD	GROUP	SUB-GROUP

18. SUBJECT TERMS *(Continue on reverse if necessary and identify by block number)*

19. ABSTRACT *(Continue on reverse if necessary and identify by block number)*

Data for nine tests in the computerized adaptive test pool for the Armed Services Vocational Aptitude Battery were subjected to item factor analysis by the marginal maximum likelihood method. Because each of the tests was represented by three distinct forms to which items had been randomly assigned, the stability of the results could be examined by comparing independent analyses. Although numerous items in this pool were too easy for the sample of subjects and had to be excluded from the item factor analysis, the remaining items gave clear and generally interpretable factor solutions on all tests. The statistical significance of each principal factor after the first was tested by means of the large sample chi-square statistic corresponding to the increase in marginal maximum likelihood as successive factors were added. To allow for possible cluster effects in the sampling of respondents, a design effect of two was assumed when computing these test statistics. Apart from minor factors associated with doublets and occasional item format effects, the main factors were all interpretable. Most notably, General Science showed a physical science and biological science factor, accompanied in two of the forms by a small chemistry factor. Arithmetic Reasoning showed a distinction between business

20. DISTRIBUTION / AVAILABILITY OF ABSTRACT: ☐ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT ☐ DTIC USERS

21. ABSTRACT SECURITY CLASSIFICATION

22a. NAME OF RESPONSIBLE INDIVIDUAL: R. Darrell Bock

22b. TELEPHONE *(Include Area Code)*: (312) 702-8561

22c. OFFICE SYMBOL

DD FORM 1473, 84 MAR — 83 APR edition may be used until exhausted. All other editions are obsolete.

SECURITY CLASSIFICATION OF THIS PAGE

#19. (Continued)

arithmetic and other calculation problems. Paragraph Comprehension was unifactorial, as was, essentially, Auto Information and Electronics Information. Shop Information showed a clear distinction between Metal Shop vs. Carpentry and General Contracting. Mathematical Knowledge and Mechanical Comprehension showed small factors related to specific types of mathematical operations, on the one hand and certain classes of mechanical relationships, on the other. The most interesting finding was a clearly significant two factor solution for Word Knowledge. One of these factors appears to represent vocabulary drawn from literary sources and recreational reading, and the other from television and the news media. Implications of these findings for vocational testing are discussed.

ABSTRACT

Data for nine tests in the computerized adaptive test pool for the Armed Services Vocational Aptitude Battery were subjected to item factor analysis by the marginal maximum likelihood method. Because each of the tests was represented by three distinct forms to which items had been randomly assigned, the stability of the results could be examined by comparing independent analyses. Although numerous items in this pool were too easy for the sample of subjects and had to be excluded from the item factor analysis, the remaining items gave clear and generally interpretable factor solutions on all tests. The statistical significance of each principal factor after the first was tested by means of the large sample χ^2 statistic corresponding to the increase in marginal maximum likelihood as successive factors were added. To allow for possible cluster effects in the sampling of respondents, a design effect of two was assumed when computing these test statistics. Apart from minor factors associated with doublets and occasional item format effects, the main factors were all interpretable. Most notably, General Science showed a physical science and biological science factor, accompanied in two of the forms by a small chemistry factor. Arithmetic Reasoning showed a distinction between business arithmetic and other calculation problems. Paragraph Comprehension was unifactorial, as was, essentially, Auto Information and Electronics Information. Shop Information showed a clear distinction between metal shop vs. carpentry and general contracting. Mathematical Knowledge and Mechanical Comprehension showed small factors related to specific types of mathematical operations and certain classes of mechanical relationships, respectively. The most interesting finding was a clearly significant two factor solution for Word Knowledge. One of these factors appears to represent vocabulary drawn from literary sources and recreational reading, and the other from television and the news media. Implications of all of these findings for vocational testing are discussed.

FULL INFORMATION ITEM FACTOR ANALYSIS OF TEST FORMS FROM THE ASVAB CAT POOL

by

Michele F. Zimowski
National Opinion Research Center

and

R. Darrell Bock
The University of Chicago

June 4, 1987

Item factor analysis serves important functions in test development based on item response theory (IRT). When implemented by maximum likelihood estimation, it provides likelihood ratio tests of the statistical significance of factors successively added to the model. In large samples, these tests provide a rigorous check on the unidimensionality required by conventional item response models. Although failure to demonstrate statistical significance, which necessarily depends upon sample size, does not imply the absence of such factors in the population, it does indicate that the sample has insufficient information to justify the identification and interpretation of the putative factors.

The estimated loadings on a statistically significant factor are also informative. Inspection of rotated loadings helps identify items belonging to minor factors that are responsible for conditional dependency among responses. These factors sometimes arise in the form of "doublets" due to excessive similarity in the formats of a pair of items. When they appear on the same test form, doublets are often a sign of poor item writing practices. They tend to occur when the item writer merely varies a previous item rather than creating a new item based on an independent idea. Item factor analysis is an effective technique for detecting such derelictions.

On the positive side, item factor analysis can detect item clusters that correspond to important, but unsuspected, components of the cognitive tasks required by the items. Often, the nature of the component can be inferred

from similarities in the content and format of the items that compose the cluster. In those occasional cases where a statistically significant factor emerges for which the item content offers no clear interpretation, the analysis signals that new data from specially constructed form items and tests may be necessary to identify the cognitive basis of the factor. An example of one such difficult-to-identify factor is found in the present study.

Although factors are ordinarily discussed in terms of communalities between tests or items, it is well to remember that they imply dimensions of individual differences in the population of examinees. Distinct factors may arise because subgroups of persons in the population having similar education or experience respond differentially to different classes of items. Such factors are often apparent in educational tests when the content is drawn from a wide range of curricular topics taught in a variety of courses. Persons following different programs of study then become distinct populations in respect to their typical pattern of responses to the test items. As we shall see, tests of general science and mathematics knowledge are likely to show these effects, while a different type of subgroup effect appears in word knowledge.

In the present application, the item factor analyses are intended *only* as explorations of the data. They are not meant to support subtest scoring or multidimensional adaptive testing. Nevertheless, those solutions that show minor common factors can provide a basis for estimating scores on the first principal factor if a method of scoring is used that does not assume conditional independence. In section 5, we discuss a procedure for estimating such scores when the partial correlation matrix for the remaining common factors is given. Item factor analysis provides a method of estimating the partial correlation matrix required in that procedure.

1. Purpose and Background

The purpose of the present study is to examine the factor composition of nine power tests developed for a prospective computerized adaptive (CAT) version of the Armed Services Vocational Aptitude Battery (ASVAB). The present tests consist of entirely new items written for the Omnibus Item Pool and Test Development Project of the Air Force Human Resources Laboratory (Contract F-33615-81-0020). These tests are unusually favorable for item factor analysis in that each is represented in three or more forms composed of randomly assigned items. The existence of randomly replicated forms provides an opportunity to check the reproducibility of the factor patterns

obtained in the analyses. In addition, the item writing instructions and strategies are thoroughly documented in a technical report by Prestwood, Vale, Massey, and Welsh (1985). Any communalities of item sources or content that might arise from the item writing procedures are potentially identifiable from this information.

An obstacle to the interpretation of the factor patterns is that the items are still secure and cannot be exhibited in a report of this kind. In describing the results, we have tried to convey verbally the attributes of the items that appear to affect the factor structure. Readers who have access to the original test booklets can examine our interpretation in the light of the tables of factor loadings presented at the end of this report.

2. The data

Data for the present study were collected originally to calibrate an item pool for a computerized version of the Armed Services Vocational Aptitude Battery. The Prestwood, Vale, Massey, and Welsh (1985) report contains a description of the sample and the methods of data collection. Forms of the nine power tests of the ASVAB constructed from items previously field tested in Recruit Training Centers (RTC) were assembled in 43 distinct test booklets. Items for each test were assigned randomly to the corresponding booklets and ordered randomly within booklets. The number of booklets per test and items per booklet are shown in Table 1 taken from Table 28 of Prestwood, Vale, Massey, and Welsh (1985). In the present study, we have analyzed data from the first three booklets of each test for which 3 or 4 booklets were available, and booklets 1, 3 and 5 of those tests comprising 5 or more booklets. In all, 24 distinct factor analyses were performed.

Subjects for the study were young men and women who had volunteered for enlistment in the Armed Services and were undergoing qualifications testing. Both the tests from the CAT pool and an operational ASVAB were administered at Military Entrance Processing Stations (MEPS) and by Mobile Examining Teams (METs) thoughout the nation. Each examinee in the study took one of the 43 CAT pool forms before taking the ten tests of an operational form of the ASVAB. Item responses for these two phases of testing were marked by the examinees on separate answer sheets identified by the examinee's social security number. The data were later collated by matching on those numbers. Unfortunately, errors made by the examinees in recording their social security numbers on machine scorable answer sheets

resulted in about 20 percent of unmatched forms. Because the present study is based on the master file of matched data, it is based on a range of sample sizes from 2,468 to 2,952 cases, rather than the 2,888 to 3,510 cases in the original data.

The effect of this inadvertent selection on a cognitive criterion (coding of a social security number), together with a general tendency of the performance of these examinees to exceed that of the trainees who took the experimental versions of the items a year earlier (possibly with poorer motivation; see Prestwood, Vale, Massey, and Welsh, 1985), resulted in a substantial number of items having sample difficulties (or, more correctly, "facilities") in excess of 90 percent correct. In addition, a few items were excessively difficult at less than 10 percent correct. Because items at both these extremes are virtually noninformative for item factor analysis, and can cause difficulties in obtaining convergence of the iterative maximum likelihood solution, we excluded all items with sample facilties greater than .925 or less than .075.

3. Analysis

The TESTFACT implementation (Wilson, Wood, & Gibbons, 1984) of the full-information method of item factor analysis, introduced by Bock and Aitkin (1981) and discussed by Bock, Gibbons, and Muraki (1986), was used in this study. The procedure is based on the Thurstone multiple factor model and assumes a multivariate normal distribution of ability. Normal ogive item response functions are assumed. In addition, because the examinees were explicitly instructed to guess if they did not know an answer, a nonzero lower asympote was assumed. Estimates of the lower asymptotes of the items for this model were obtained from separate BILOG (Mislevy & Bock, 1984) analyses of the test forms. In these preliminaries and in the factor analyses, items left blank between responded-to items were treated as omits and scored as fractionally correct at the asymptote value. Items left blank following the last non-omitted item, on the other hand, were scored as "not- presented." This scoring method assumes that examinees who fail to complete the test do so because they run out of time. It avoids the spurious factor associated with item position that results when non-reached items are scored as incorrect.

In addition to the many items with percent corrects below .075 and above .925, a few were excluded because their lower asymptote values were greater than or equal to their facilities. This is an indication that the item is too difficult for the examinees and may have a nonmonotonic response function.

Such items are likely to cause convergence problems in the analysis. The numbers of items retained in each form are shown in Table 1. The items retained in each form are identified by their numbers in the test booklets in Tables 2-28. The number of examinees who responded to each item (attempts) is shown along with estimates of the guessing parameters (chance) and percents correct (facilities).

In connection with the statistical tests of the number of factors, we must consider that the data were obtained from volunteers at MEPS sites and do not constitute a well-defined sample. As a result, there is some uncertainty about the multinomial distribution assumptions on which the likelihood ratio tests are based. In particular, the localized catchment areas of the recruiting centers may introduce intraclass correlation effect similar to that associated with cluster sampling. This effect tends to inflate the likelihood ratio chi-square statistics above the level expected for independent multinomial trials in a single population.

For this reason, a positive design effect probably should be assumed when setting a critical point for the likelihood ratio chi-square statistic. To avoid overinterpreting the data, we have taken the design effect to be in the range of 2 to 3 and have considered the evidence for additional factors to be clear only when a change of chi-square upon addition of a factor is four or five times the change in degrees of freedom. Because of the large sample sizes in this study, changes that correspond to clearly defined factors are often much larger, of the order of ten times the change in degrees of freedom, and leave little doubt as to the reality of the factor. In addition to the statistical criteria, substantive considerations often establish the existence of the factor beyond any reasonable doubt. The communality of content among items that have large loadings on the factor usually make it clear that a real cognitive component has been identified. In other cases a clear doublet, two items with some similar features displaying isolated high factor loadings, is often responsible for the statistical result.

4. Results

As an aid to interpretation, factor loadings are shown in Tables 2 through 28 both in their orthogonal principal factor form and in promax factor loadings computed from a preliminary varimax target. Accompanying the principal factors is the percent of total variance associated with each. These tables also contain the item intercepts, principal factor variances, correlation of the

promax factors, change in chi-squares, degrees of freedom, and probability levels due to the inclusion of additional factors. The correlation of the promax factors is the cosine of the angle between the rotated axes. It tends to overestimate the true correlation. The values of the change chi-squares are adjusted to reflect an assumed design effect of 2. These results are based on a maximum of 45 EM cycles of the marginal maximum likelihood solution.

The sensitivity of the full-information method to departures from conditional independence is clearly demonstrated in these analyses. Even with an assumed design effect of 2, associations between as few as two items are detected in the change chi-squares. Except for a few illustrative examples, higher dimension solutions with factors largely defined by only two or three items are not shown. Factors of this type tend to represent minor departures from conditional independence due to item format similarities rather than distinct sources of individual differences in cognition. In the following descriptions of each analysis, the results are compared with the earlier work of Bock, Gibbons, & Muraki (1986), who analyzed responses to ASVAB Form 8A of 1000 cases from the Profile of American Youth survey (see Bock & Moore, 1986).

General Science (GS)(Tables 2-4). All three test forms yield at least three significant factors readily interpreted in the promax rotation. Promax Factors 1 through 3 of Form 3 exhibit the clearest separation of general science items into three content areas, namely, physical sciences, chemistry, and biological sciences, respectively. These factors are substantially intercorrelated (r=.74-.81), and a large percent of the variance is attributable to the first principal factor (50.3).

Perhaps because fewer chemistry items appear in Form 1, it exhibits a similar but less clear separation of items into these groupings. Promax Factors 1, 2, and 3 of this form also correspond to biology, the physical sciences, and chemistry. Relative to Form 1, these factors are less highly correlated (r=.67-.74), and the first principal factor accounts for less of the variance (45.71 percent).

The relative absence of chemistry items in Form 2 is reflected in its factorial structure. The first promax factor of this form is largely represented by biology items, the second by physical science items. The third factor is almost exclusively defined by a doublet, items 2 and 53, both of which ask about the solar system.

The finding of factors that correspond to biology and physical science agrees with the Bock, Gibbons, and Muraki (1986) analysis of a test form from this area. Probably because of variation in test form composition, their evaluation failed to reveal the chemistry factor found here in two of three forms.

Arithmetic Reasoning(AR)(Tables 5-7). Two factors of arithmetic reasoning are statistically significant in all forms. The factors of each solution are substantially intercorrelated (r=.74-.81), and approximately 54 percent of the variance is attributable to the first principal factor in each form. These results agree with those of Bock, Gibbons, and Muraki (1986), who suggest that the test measures a "business arithmetic" factor in addition to a more general arithmetic reasoning factor. Items that appear to assess the business factor in this examination include questions about percentages (item 33 of Form 3, items 14, 23, and 29 of Form 5) and earnings and expenditures (items 5, 12, 15, and 17 of Form 1, items 1 and 21 of Form 3). The second promax factor of Forms 1 and 3 corresponds to this business factor: in Form 5, the business items appear in the first factor. The separation of business arithmetic from general items is not always complete: item 28 of Form 1, for example, requires computation of percentages but loads almost exclusively on the general arithmetic reasoning factor.

Word Knowledge(WK)(Tables 8-10). The interpretation of the substantial second factor in all three forms of the Word Knowledge test is not obvious upon first inspection. No distinctive contrast of the words by grammatical class, Latin or Anglo-Saxon origin, frequency in conventional word lists, etc., meets the eye when words with high loadings on the two factors are compared. The difference between them becomes apparent, however, when we recall that the existence of distinct factors in test performance corresponds to some behavioral classification of persons in the population from which the examinees have been sampled. The existence of two statistically significant factors with substantial loadings on many items suggests that the population of young people from which the present sample was drawn consists of two broad groups who differ in their exposure to the kind of words that appear in the Word Knowledge tests. Because these words must be capable of discriminating between persons in this population, they cannot be those found in everyday conversation and thus known to almost everyone. To be useful for testing word knowledge, the words in the test items must be

less common, more specialized, and acquired from rather more intellectual sources.

Two such sources likely to increase word knowledge suggest themselves. One is recreational reading—reading that consists predominantly of fiction or similar narrative literature available widely in magazine, paperback and book club publications. The other source is journalistic and television media, including the news and editorial sections of newspapers, the news programs on television, and television commercials. Undoubtedly, there must now exist a substantial proportion of young people who do relatively little recreational reading, but depend for similar diversion on television and motion pictures. Clearly, the vocabularies of recreational reading and those of recreational television and film media are different in one important respect: the former necessarily contains a considerable corpus of words descriptive of physical locations, appearances and actions of persons, and of human feelings and relationships; the latter contain very little of these classes of words—the ability of television and film to depict scenes, expressions and situations visually makes verbal description unnecessary. Persons who find entertainment predominantly in the visual media must therefore have relatively less exposure to the vivid and descriptive vocabulary of fiction and other literature. Their main source of more specialized words must be the front page and television news, commentary, and commercials.

When the factor analysis of the three word knowledge forms in the CAT pool are inspected with this hypothesis in mind, a clear interpretation of the words loading most heavily on the first two factors emerges. If the words with promax loadings in excess of 0.5 on the respective factors are listed and compared, the distinction between a more descriptive and vivid vocabulary in one of the factors, and a more matter-of-fact, current-event and technically oriented vocabulary is apparent. Roughly, we might call the first of these the "literary" vocabulary and the second the "media" vocabulary. The former contains words one might expect to encounter in popular romances and adventure stories. The latter is made up of words from the law, business, politics, government military and other impersonal content. The resolution of these factors is clearest in WK3, where we first identified it. Except for a few misclassified words in the literary factor, the distinction is almost as clear in WK1. In WK2, however, literary words are not as well represented, and identification of the factors is more problematical.

Because we are not free here to divulge the actual words, we would encourage readers who have access to the test forms to attempt to verify our interpretation of the promax loadings of the two factors shown in Tables 8-10.

Very likely the distinction between the vocabularies of popular fiction and of journalism is also the basis of the two factors found by Bock, Gibbons and Muraki in ASVAB Form 8A. Because that form contains only 36 items and has relatively few words drawn from fiction or recreational reading, the distinction, although apparent, is not as clearly resolved as in the longer tests of the CAT pool. It is of considerable interest, however, that in the item bias analysis of Form 8A reported by Bock and Mislevy (1981), they call attention to a quite similar item $\times$ socioeconomic group interaction. They describe the interaction as a contrast between "literary" words and "media" words, the terms we have adopted here. This type of interaction might be expected if the subpopulations of young people that give rise to word knowledge factors divide along social class lines, presumably with the lower class population doing less recreational reading. Another possible hypothesis is that there is a sex difference with respect to these factors, with women more heavily represented among the recreational readers. Bock and Mislevy, did not, however, find an item by sex interaction for Word Knowledge in Form 8A.

Paragraph Comprehension(PC)(Tables 11-13). The paragraph comprehension items for the CAT pool are designed to be brief enough to fit on one display screen and to require only one response per paragraph. The purpose of the latter restriction is to avoid possible failures of conditional independence due to more than one item being derived from the same paragraph. The analysis of ASVAB form 8A reported in Bock, Gibbons, and Muraki (1986) appears, however, to indicate that this restriction is not necessary. There was no evidence that responses to items based on the same paragraph in Form 8A showed greater association than those for items based on different paragraphs. These results suggest that, for a given amount of testing time, a more dependable score for paragraph comprehension could be obtained by asking more than one question per paragraph.

In accord with previous results (Bock, Gibbons, & Muraki, 1986), the change chi-squares from Form 1 indicate that the Paragraph Comprehension test is unidimensional. There is, however, evidence for a second factor in both Forms 3 and 5, but neither the promax nor the varimax two-factor solutions

(not shown) have obvious interpretations. The second principal factors of Forms 3 and 5 make only minor contributions to the variance, 2.10 and 2.70 per cent, respectively, and are substantially correlated, r=.79 and r=.78, with their first factors. Even though the item features responsible for these minor departures from conditional independence could not be identified, there is little reason to believe that the second factors of these solutions represent distinct cognitive dimensions. Thus, only the results from the one-factor solutions are presented in Tables 11 through 13.

Automotive Information(AI)(Tables 14-16). Although there is evidence for at least three factors in all three forms, neither the promax nor the varimax solutions of any form have obvious interpretations. The second and third principal factors of these solutions (not shown) account for a relatively small percentage of the variance, 2.23-2.68 and 1.21-1.32 percent, respectively.

In the two-factor solutions (not shown), there is some suggestion of a contrast between items requiring technical expertise and those requiring knowledge of automotive service and maintenance, but there are numerous inconsistencies. The correlations between the promax factors of these solutions (r=.82-.83) are among the highest found for any form in any subject area, and only small percents of variance are attributable to the second principal factors (1.89-2.04). Because there is little evidence that these departures from conditional independence represent distinct content, the one-factor solutions are presented in the tables.

Shop Information(SI)(Tables 17-19). There is evidence for at least three factors in all three forms, but the third principal factors of these solutions (not shown) make only minor contributions to the variance, (1.70, 1.63, and 1.91 percent, respectively). The third factors of the promax-rotated solutions exhibit substantial correlations with the first and second factors, (r=.74, .71, r=.81, .74, and r=.78, .74, respectively, for Forms 1, 2, and 3), and are not easily interpreted. The two-factor solutions yield results anticipated in the Bock, Gibbons, and Muraki analysis of the Auto and Shop Information test from ASVAB Form 8A. In a third factor that was not clearly signficant, they observed support for a distinction between the metal and wood shop items of the test. The two factors found in the present examination roughly correspond to this distinction. The first appears to represent practical knowledge of building and carpentry, and the second, more specialized

knowledge of metal shop.

Form 3 provides the clearest evidence in favor of this interpretation. Of the twelve items with loadings larger than .60 on the first promax factor, all but one (item 19) involve knowledge of building and carpentry. Of the four items (items 2, 27, 49, and 53) that largely represent the second promax factor, all involve knowledge of metal shop. The pattern of loadings from Forms 1 and 2 also support this distinction but not so clearly.

Mathematics Knowledge(MK)(Tables 20-22). There is evidence in the change chi-squares for at least three factors of mathematical knowledge in all three test forms. The item features responsible for these departures from conditional independence are readily identified and differ by form. Most of the factors represent similarities in format attributes rather than distinct sources of individual differences in cognition. Nonetheless, they are presented to illustrate the departures from conditional independence that may occur when tests contain items with similar features.

The first principal factor of Form 1 is responsible for a larger percent of variance (59.17) than the first principal factor of any other test form in any subject area. This fact reflects the relatively large number of items that exhibit substantial loadings on this factor. There is every indication that it represents general knowledge of mathematics. Inspection of its promax-rotated factor loadings reveals that some of the items with large loadings assess the ability to manipulate and solve equations with unknowns (items 5, 24, 27, 32, 43), while others require knowledge of geometric principles (items 15 and 25). Still others involve the factorization of polynomials (items 4 and 38) or demand an understanding of absolute values (items 19 and 42). In contrast, the second promax factor of Form 1 is almost exclusively defined by items that require the examinee to find the least common denominator of several fractions (items 6, 10, 34, 41, 45). These items not only involve the same mathematical principle but also use the same item stem. Similarly, the three items responsible for the third factor all require conversion of mixed numbers into fractions. The two items that exhibit the highest loadings (over .9) on this factor, items 12 and 29, share the same stem. Item 44, which has a smaller loading (.63), also requires the examinee to solve for an unknown.

Form 3 exhibits a different structure. With few exceptions (items 9, 14, 21, and 30), items that define the first factor require knowledge of formal algebra. Items that exhibit substantial loadings on the second factor of this

form often demand knowledge of geometry, but sometimes involve algebra. The third factor is entirely defined by a doublet, items 33 and 46; both require conversion of fractions into mixed numbers and share the same stem.

As in Form 3, most of the items that load on the first factor of Form 5 demand knowledge of formal algebra. Items with the largest loadings involve manipulation of polynomials. The second factor is largely defined by four items requiring the examinee to solve for an unknown found in the numerator or denominator of an expression. The two items with loadings larger than .90 also have a common stem. Only a small percent (1.62) of the variance is attributable to the third factor, which is largely defined by two items (8 and 18) that share the same stem; they ask the examinee to find the coordinates of a plotted point.

The analysis of the Mathematics Knowledge tests provides other examples of dependencies that may occur when items in a test share the same stem. What remains uncertain is the association of the item features with individual differences in mathematical knowledge. The results provide some support for a factor representing knowledge of formal algebra, but it fails to reveal the numerical calculation and reasoning factors found in other studies (Bock, Gibbons, & Muraki, 1986). Variation in item composition of the test forms could account for these differences.

Mechanical Comprehension(MC)(Tables 23-25). Although there is evidence for at least three factors in all forms, the third factors of Forms 1 and 5 and the second factor of Form 3 are defined by doublets. In the two-factor solutions of Forms 1 and 5, there is some support for a distinction between simple lever and pulley problems, in contrast to problems involving complex linkages. The clearest evidence for this distinction is found in the pattern of loadings from the first form: three of the five items exhibiting substantial loadings (over .70) on the first factor are simple lever and pulley problems; those exhibiting the largest loadings on the second factor, items 25, 29, and 41, all involve complex linkages.

Electronics Information(EI)(Tables 26-28). There is evidence for at least three factors in all three test forms of Electronics Information. Many of the factors from the three-factor solutions (not shown) are defined by doublets. The two items (39 and 45) exhibiting the largest loadings on the second promax factor of Form 1 both ask about circuit overload, while the two items (26 and 42) largely responsible for the third factor of this form

both involve soldering irons and heating. Similarly, the second factor of Form 3 is almost exclusively defined by two items (18 and 23) that require knowledge of charged particles.

There is some support in the two-factor solution of Form 1 (not shown) for a distinction between formal knowledge of electronics and knowledge acquired through practical experience, but the classification of many of the items is ambiguous. In all, the higher dimension solutions of the three test forms provide little support for distinct sources of individual differences in electronics knowledge. The second and third factors of these solutions account for relatively small percentages (1.61-3.47) of variance.

Only the results from the one-factor solutions are presented in Tables 25-27. The principal factors of these forms account for a smaller percent of variance (35.23-39.38) than the first factors of all other solutions. The content of these tests is highly heterogeneous.

5. Discussion and Conclusions

As would be expected for tests designed and constructed to be unidimensional, variation in the test scores is dominated by the first principal factor. Variance associated with second and third factors, even when clearly significant, is small. This does not diminish the potential importance of the factors as indicators of an underlying cognitive process component, but it does mean that the component could not actually be measured without development of additional items that depend more strongly on these processes.

In other cases, the factors correspond merely to doublets that arise from nearly identical items that should not have been included in the same test form. These cases can be avoided by more careful test editing. On the whole, the present study confirms the typical finding that cognitive tests tend to show a dominant general factor and one or more group factors associated with identifiable subtypes of items. In this situation, the test constructor can pursue either of two courses. He may choose to emphasize the general factor and suppress the group factors by making the item content more homogeneous, or he may fix on the group factors and try to develop additional items that will make them estimable in the form of separate scores for each factor. The first course risks some loss of information, and the second may give more detail than required in the practical use of the test battery.

As a rule, when a vocational test is found not to be unidimensional, an attempt to divide the test into unidimensional subtests should be made only

if there is a clear distinction between the cognitive skills involved. Moreover, these skills should correspond to distinctions between the vocational specialties for which the test is supposed to predict performance. In the case of the General Science test, the distinction between the physical sciences and the biological and health sciences seems worth retaining and developing into separate scales. These scales would be expected to be differentially predictive for the medical occupational specialties as opposed to technical specialties involved with mechanical equipment. Similarly, the distinction between business arithmetic and other arithmetic skills might be exploited to improve predictability of performance in the administrative and clerical specialities. The two factors in the Word Knowlege test may present opportunities for improved prediction in jobs that require creative use of language background, but the necessary studies are lacking at present. Finally, division of shop information into metal working vs. carpentry and general maintenance would be pertinent to numerous occupational specialties.

The multidimensionality of mathematics knowledge and mechanical comprehension, in contrast, does not directly relate to any occupational specialty and would be of little value for predictive purposes. In this case, the best course would appear to be to attempt to maintain some balance of the various content categories included in these tests and to rely on the first principle factor to define a general skill dimension in each topic. Unfortunately, maintaining content balance during adaptive testing will be difficult, both in finding enough items to span all of the topics, and in selecting from them during adaptive testing. A scheme for rotating through the content topics as the items are selected would be required. Two-stage testing, which is easier to implement and almost as efficient, might be preferable to fully adaptive testing in this situation.

To account for the failures of conditional independence that would result when items are selected from the same types of content in a structured item domain, a method of IRT scale score estimation that does not assume complete conditional independence would be desirable. A method for this purpose has been proposed by Gibbons and Bock (1987), based on the principal factor structure obtained by full-information item factor analysis.

This procedure combines a one-dimensional quadrature on the first principal factor with a so-called "Clark algorithm" to compute the probability of the answer pattern conditional on the first factor. In this procedure, the

orthant probabilities corresponding to binary responses scored 1 for correct and -1 for incorrect are approximated using the partial correlation matrix implied by the factor loadings other than the first principal factor. Gibbons and Bock (1987) have found in extensive Monte Carlo simulations that the Clark algorithm is highly accurate when the correlations are relatively small, as they almost always are cognitive test data when contributed by principle factors other than the first. This method is suitable for conventional, two-stage, and adaptive testing, but it requires principal factor loadings for all items. These loadings can be estimated by the marginal maximum likelihood method.

REFERENCES

Bock, R.D., & Aitkin, M. (1981). Marginal maximum likelihood estimation of item parameters: an application of an EM algorithm. *Psychometrika*, **46**, 443-459.

Bock, R.D., Gibbons, R.D. & Muraki, E. (1986). *Full-Information Item Factor Analysis*. Chicago: NORC.

Bock, R.D. & Mislevy, R.J. (1981). *The Profile of American Youth: Data Quality Analysis of the Armed Services Vocational Aptitude Battery*. Chicago: NORC.

Bock, R.D. & Moore, E.J.G. (1986). *Advantage and Disadvantage: A Profile of American Youth*. Hillsdale (N.J.): Erlbaum.

Gibbons, R.D. & Bock, R.D. (1987). Calculating Orthant Probabilities. Paper submitted for reading at the Psychometric Society Meeting, McGill University, June.

Mislevy, R.J. & Bock, R.D. (1984). BILOG: Maximum Likelihood Item Analysis and Test Scoring—Logistic Model. Mooresville (Ind.): Scientific Software, Inc.

Prestwood, S.J., Vale, C.D., Massey, R.H. & Welsh, J.R. (1985). *Armed Services Vocational Aptitude Battery: Development of an Adaptive Item Pool*. AFHRL-85-19. San Antonio: Brookes Air Force Base.

Wilson D., Wood, R. & Gibbons, R.D. (1984). TESTFACT: *Test Scoring, Item Statistics, and Item Factor Analysis*. Mooresville: (Ind.): Scientific Software, Inc.

TABLE 1

Number of Booklets and Items per Booklet in Calibration

Content Area	Number of Booklets	Items per Booklet	Total Items	Booklets Analyzed	# of Items Retained in Analyzed Booklets
General Science	4	57	228	1,2,3	47,41,38
Arithmetic Reasoning	7	35	245	1,3,5	24,24,23
Word Knowledge	3	86	258	1,2,3	37,50,55
Paragraph Comprehension	7	33	231	1,3,5	25,28,28
Automotive Information	4	60	240	1,2,3	44,41,48
Shop Information	4	57	228	1,2,3	47,50,47
Mathematics Knowledge	5	46	230	1,3,5	41,44,42
Mechanical Comprehension	5	46	230	1,3,5	42,40,40
Electronics Information	4	57	228	1,2,3	41,42,48

TABLE 2

ASVAB
ITEM ATTEMPTS, FACILITIES, GUESSING PARAMETER VALUES, STANDARD DIFFICULTIES, AND FACTOR LOADINGS
GENERAL SCIENCE-FORM 1 ($N = 2902$)

Item	Attempts	Facility	Chance	Intercept	Principal Factors 1	Principal Factors 2	Principal Factors 3	Promax Factors 1	Promax Factors 2	Promax Factors 3
2	2896	0.552	0.1158	0.0173	0.7223	0.0421	−0.1614	0.515	0.324	−0.059
3	2889	0.287	0.1563	1.0244	0.8011	−0.1314	−0.0256	0.474	0.143	0.271
4	2896	0.494	0.0719	0.1113	0.6595	0.1934	0.0684	0.040	0.581	0.109
5	2899	0.721	0.1877	−0.4085	0.4714	0.2677	−0.0112	0.024	0.587	−0.099
6	2883	0.461	0.2275	0.5144	0.7602	−0.1010	0.0587	0.311	0.193	0.347
8	2882	0.469	0.2638	0.5852	0.6727	−0.1859	−0.1271	0.608	−0.019	0.148
9	2897	0.281	0.1781	1.1534	0.6991	−0.2198	0.3050	0.008	0.063	0.744
10	2893	0.563	0.2696	0.2390	0.7582	−0.1386	−0.0674	0.523	0.102	0.211
13	2894	0.487	0.2077	0.3828	0.7342	−0.0899	−0.2183	0.699	0.121	−0.029
14	2899	0.554	0.1194	0.0129	0.7717	0.0411	−0.1586	0.533	0.344	−0.042
15	2882	0.275	0.1561	1.0975	0.7925	0.0535	0.0920	0.164	0.441	0.281
16	2888	0.385	0.2797	1.1101	0.8044	−0.1652	−0.1993	0.756	0.047	0.071
17	2893	0.645	0.3438	0.1085	0.6711	−0.0450	−0.2372	0.668	0.154	−0.104
18	2897	0.154	0.0567	1.2537	0.6757	−0.1064	0.1854	0.092	0.185	0.495
19	2897	0.736	0.1559	−0.4974	0.5586	0.3301	−0.0028	0.003	0.717	−0.114
20	2892	0.194	0.1457	1.8358	0.7123	−0.2605	0.2642	0.103	−0.002	0.725
21	2901	0.882	0.2087	−1.0496	0.3879	0.2839	−0.0179	−0.014	0.573	−0.142
22	2894	0.420	0.1673	0.5292	0.6713	0.2620	0.1239	−0.086	0.701	0.132
24	2888	0.426	0.3912	1.5752	0.6599	−0.2984	−0.1939	0.783	−0.207	0.143
25	2898	0.656	0.1448	−0.2559	0.5387	0.1723	0.1717	−0.148	0.528	0.229
26	2893	0.686	0.3862	0.0189	0.7387	−0.1775	−0.1302	0.635	0.020	0.154
27	2896	0.817	0.1367	−0.8109	0.5783	0.3819	0.0140	−0.051	0.805	−0.127
28	2888	0.403	0.2902	0.9730	0.6439	−0.2203	0.1937	0.149	0.008	0.585
30	2893	0.322	0.0657	0.6084	0.7913	0.1588	0.1064	0.066	0.598	0.219
31	2897	0.543	0.3894	0.6735	0.7080	−0.0054	0.0219	0.273	0.300	0.213
32	2898	0.841	0.2501	−0.8084	0.5735	0.0715	−0.0265	0.232	0.341	0.057
33	2900	0.903	0.2105	−1.1671	0.3053	0.2227	−0.0274	0.009	0.446	−0.128
35	2887	0.324	0.1850	0.9584	0.6939	−0.1354	−0.0508	0.469	0.084	0.214
36	2897	0.734	0.2486	−0.3820	0.6063	0.0926	−0.0196	0.220	0.387	0.058
37	2882	0.332	0.1892	0.9462	0.6964	−0.1621	−0.1419	0.623	0.021	0.116
38	2892	0.423	0.1577	0.4598	0.7911	−0.2424	−0.0219	0.545	−0.022	0.358
39	2895	0.848	0.1499	−0.9358	0.6369	0.2424	0.0072	0.085	0.626	−0.014
40	2897	0.512	0.1103	0.1120	0.6335	−0.1050	0.1810	0.080	0.168	0.478
41	2885	0.313	0.1931	0.9980	0.7199	−0.3621	0.2038	0.269	−0.163	0.726
42	2876	0.458	0.3620	1.0556	0.4926	0.0325	−0.0589	0.273	0.241	0.024
43	2900	0.833	0.1753	−0.8599	0.7594	0.1463	−0.1316	0.411	0.499	−0.090
45	2897	0.430	0.2736	0.8105	0.7344	−0.0041	−0.1580	0.549	0.263	−0.016
46	2898	0.867	0.1805	−0.9940	0.3928	0.2562	0.0872	−0.146	0.564	0.018
47	2881	0.156	0.1427	2.1494	0.7631	−0.1606	0.1999	0.147	0.147	0.578
48	2898	0.761	0.2118	−0.5332	0.7966	0.1267	−0.0600	0.336	0.507	0.028
49	2892	0.702	0.2639	−0.2401	0.6769	0.2506	−0.0089	0.120	0.650	−0.031
50	2896	0.595	0.1424	−0.0749	0.6350	0.1414	−0.0252	0.205	0.469	0.021
52	2888	0.397	0.0977	0.4460	0.7311	0.0235	−0.0802	0.413	0.323	0.064
54	2884	0.547	0.2095	0.1958	0.6925	0.0972	−0.1091	0.385	0.406	−0.040
55	2888	0.910	0.2211	−1.2090	0.6000	0.3314	0.1221	−0.164	0.771	0.059
56	2888	0.497	0.1725	0.2736	0.5248	0.1706	0.1857	−0.173	0.523	0.245
57	2863	0.441	0.2564	0.6673	0.8566	−0.1997	0.0333	0.461	0.084	0.414

Adding Factor	Chi-Square* Change	d.f.	p	Percent of Variance 1	Percent of Variance 2	Percent of Variance 3		Factor Correlations 1	Factor Correlations 2	Factor Correlations 3
2	285.771	46	< .001	45.7050	3.7421	1.7984	1	1.000		
3	121.702	45	< .001				2	0.739	1.000	
							3	0.736	0.667	1.000

* Assumed design effect = 2.

TABLE 3

ASVAB
ITEM ATTEMPTS, FACILITIES, GUESSING PARAMETER VALUES, STANDARD DIFFICULTIES, AND FACTOR LOADINGS
GENERAL SCIENCE-FORM 2 (N = 2727)

Item	Attempts	Facility	Chance	Intercept	Principal Factors			Promax Factors		
					1	2	3	1	2	3
1	2713	0.229	0.1307	1.2357	0.6902	0.0399	−0.0164	0.238	0.422	0.085
2	2725	0.643	0.1062	−0.2602	0.6216	0.3511	0.3986	0.020	0.006	0.802
3	2701	0.301	0.1920	1.1197	0.8553	−0.2754	0.1195	0.865	−0.003	0.071
5	2726	0.746	0.2201	−0.4600	0.6263	−0.0535	−0.1176	0.281	0.466	−0.110
6	2722	0.637	0.1146	−0.2289	0.5744	0.1380	−0.0820	−0.001	0.559	0.053
7	2726	0.866	0.1953	−0.9899	0.6690	0.1898	0.0344	0.041	0.468	0.244
9	2726	0.909	0.1883	−1.2248	0.4162	0.1393	0.0064	−0.016	0.335	0.147
10	2722	0.901	0.5000	−0.8621	0.7978	−0.2335	−0.1185	0.622	0.390	−0.208
11	2724	0.826	0.2170	−0.7770	0.7104	0.0509	−0.1503	0.143	0.659	−0.074
12	2719	0.323	0.0909	0.6692	0.6436	0.0220	0.0006	0.255	0.354	0.090
13	2722	0.636	0.1236	−0.2096	0.6239	0.2409	−0.1488	−0.175	0.787	0.041
14	2725	0.777	0.2364	−0.5593	0.7013	0.0620	0.0690	0.266	0.311	0.208
16	2726	0.458	0.2344	0.5748	0.7847	0.2820	0.0650	−0.024	0.564	0.356
17	2719	0.151	0.1204	1.8289	0.7809	0.1779	0.2165	0.227	0.222	0.479
18	2716	0.360	0.2048	0.8606	0.6728	−0.3308	0.1629	0.894	−0.219	0.069
20	2722	0.569	0.1709	0.0533	0.7259	0.0886	−0.1263	0.110	0.663	−0.017
21	2721	0.741	0.3280	−0.2988	0.7513	−0.0489	0.0526	0.441	0.261	0.122
22	2727	0.833	0.3363	−0.6757	0.5561	0.1698	−0.1007	−0.069	0.609	0.048
23	2717	0.570	0.0856	−0.0652	0.7638	0.0995	−0.1650	0.086	0.755	−0.055
25	2714	0.321	0.1520	0.8617	0.7624	−0.1675	0.0031	0.589	0.237	−0.016
26	2718	0.415	0.1756	0.5606	0.5593	0.0748	0.0449	0.168	0.288	0.170
30	2724	0.852	0.1827	−0.9275	0.6807	0.3094	−0.1682	−0.263	0.912	0.068
31	2719	0.785	0.1354	−0.6809	0.6058	0.1431	−0.1625	−0.047	0.710	−0.042
33	2713	0.123	0.0856	1.7265	0.8777	−0.2087	0.0476	0.730	0.187	0.027
34	2719	0.382	0.0849	0.4599	0.6844	−0.0679	−0.0228	0.390	0.330	0.007
37	2723	0.692	0.3051	−0.1458	0.8440	−0.3190	0.1343	0.934	−0.073	0.060
38	2715	0.178	0.1496	1.8783	0.8041	−0.3316	0.0005	0.847	0.111	−0.121
39	2715	0.733	0.2458	−0.3861	0.8143	−0.0492	0.1224	0.515	0.181	0.217
41	2711	0.373	0.1641	0.6842	0.6188	−0.2408	0.0768	0.681	−0.025	0.012
43	2722	0.421	0.1562	0.4960	0.7541	0.0432	−0.0143	0.263	0.455	0.098
44	2717	0.263	0.2108	1.5062	0.7450	−0.2320	0.0583	0.712	0.079	0.010
45	2713	0.534	0.4135	0.8335	0.7182	−0.1582	−0.0800	0.501	0.356	−0.120
47	2723	0.874	0.3429	−0.8916	0.7145	−0.0942	−0.1120	0.384	0.465	−0.119
48	2711	0.261	0.2482	2.0895	0.7004	−0.3864	0.0692	0.927	−0.105	−0.082
49	2713	0.472	0.3197	0.7680	0.8240	−0.0836	−0.0101	0.484	0.368	0.029
51	2715	0.506	0.0810	0.0969	0.4947	0.0973	−0.0187	0.065	0.378	0.097
52	2722	0.778	0.1080	−0.6849	0.5916	0.0686	−0.2148	0.022	0.718	−0.157
53	2719	0.648	0.1424	−0.2035	0.6723	0.4709	0.3953	−0.137	0.148	0.881
55	2716	0.457	0.1882	0.4453	0.7105	0.1436	−0.2067	−0.030	0.836	−0.085
56	2717	0.900	0.1721	−1.1956	0.7462	0.2025	−0.1121	−0.040	0.756	0.077
57	2697	0.308	0.1632	0.9780	0.8202	0.1355	−0.0362	0.142	0.611	0.137
Adding Factor	Chi-Square* Change	d.f.	p	Percent of Variance				Factor Correlations		
				1	2	3		1	2	3
2	285.771	40	<.001	50.0107	4.1438	1.8967	1	1.000		
3	107.114	39	<.001				2	0.802	1.000	
							3	0.584	0.710	1.000

*Assumed design effect = 2.

TABLE 4

ASVAB
ITEM ATTEMPTS, FACILITIES, GUESSING PARAMETER VALUES,
STANDARD DIFFICULTIES AND FACTOR LOADINGS
GENERAL SCIENCE-FORM 3 (N=2639)

Item	Attempts	Facility	Chance	Intercept	Principal Factors			Promax Factors		
					1	2	3	1	2	3
2	2626	0.341	0.2866	1.5003	0.7599	−0.5203	−0.1146	−0.103	1.109	−0.146
4	2635	0.291	0.0354	0.6240	0.7344	0.1032	−0.2072	0.682	0.178	−0.063
5	2635	0.864	0.2588	−0.8965	0.7643	0.0964	−0.1531	0.616	0.166	0.046
7	2638	0.889	0.1093	−1.1659	0.7558	0.2057	0.0499	0.464	−0.129	0.467
8	2630	0.297	0.2281	1.3466	0.5351	−0.1919	0.1439	−0.179	0.374	0.389
9	2633	0.766	0.2453	−0.4887	0.5603	0.2327	−0.0002	0.480	−0.199	0.311
10	2636	0.396	0.0893	0.4359	0.7709	−0.0114	0.0284	0.264	0.229	0.340
11	2637	0.338	0.2008	0.9479	0.7895	−0.1141	−0.0201	0.224	0.424	0.214
12	2639	0.173	0.0810	1.2764	0.6733	−0.2296	0.0321	−0.016	0.540	0.218
14	2636	0.843	0.5000	−0.4689	0.6441	0.0391	0.2099	0.029	0.004	0.651
15	2635	0.309	0.1275	0.8343	0.7951	0.1982	−0.0481	0.601	−0.047	0.296
16	2638	0.240	0.1780	1.4481	0.8149	−0.2558	0.0548	−0.017	0.610	0.302
17	2626	0.500	0.2354	0.4099	0.7243	0.1177	−0.1924	0.674	0.144	−0.033
18	2634	0.341	0.2415	1.1313	0.7863	−0.3844	−0.1214	0.063	0.908	−0.091
19	2636	0.509	0.1720	0.2435	0.8246	−0.0969	0.1151	0.080	0.328	0.486
20	2633	0.412	0.1011	0.4009	0.7090	0.0237	−0.0735	0.411	0.216	0.142
23	2639	0.876	0.1975	−1.0284	0.7379	0.1612	0.0656	0.389	−0.074	0.471
24	2636	0.811	0.1763	−0.7388	0.6010	−0.0255	0.0225	0.188	0.204	0.259
26	2637	0.859	0.3794	−0.7392	0.7573	0.0958	0.0392	0.360	0.050	0.401
27	2638	0.909	0.2807	−1.1501	0.6848	0.0344	−0.2031	0.582	0.269	−0.103
28	2636	0.278	0.0831	0.7912	0.5588	−0.0967	−0.0976	0.251	0.375	−0.011
29	2635	0.835	0.4295	−0.5375	0.7208	0.0926	−0.0305	0.433	0.086	0.256
30	2638	0.887	0.2154	−1.0747	0.7339	0.0085	0.1027	0.173	0.143	0.473
32	2634	0.622	0.4474	0.4406	0.7800	−0.2969	−0.1139	0.146	0.764	−0.042
34	2633	0.840	0.1683	−0.8639	0.7216	0.0374	−0.0320	0.376	0.174	0.230
35	2630	0.567	0.1435	0.0280	0.7143	−0.0611	0.2441	−0.096	0.162	0.699
36	2634	0.792	0.1048	−0.7251	0.6770	0.1282	0.2524	0.083	−0.151	0.781
38	2636	0.893	0.1668	−1.1396	0.5956	0.0693	0.1173	0.163	−0.002	0.474
40	2639	0.889	0.1678	−1.1235	0.6800	0.0318	0.1256	0.146	0.077	0.505
41	2634	0.812	0.1177	−0.7917	0.6377	0.0576	0.1931	0.069	−0.016	0.626
42	2632	0.377	0.1006	0.5226	0.7738	0.0936	0.0262	0.382	0.066	0.382
43	2637	0.878	0.1627	−1.0636	0.6773	0.0772	−0.1028	0.494	0.140	0.099
51	2623	0.389	0.2321	0.7938	0.7529	−0.2944	0.0180	−0.036	0.674	0.194
52	2632	0.910	0.2132	−1.2105	0.6610	0.2735	−0.1950	0.820	−0.118	0.004
53	2628	0.645	0.0833	−0.2593	0.7874	0.2503	0.1566	0.386	−0.253	0.696
54	2629	0.569	0.0716	−0.0781	0.6745	0.0422	−0.0595	0.398	0.168	0.163
55	2628	0.713	0.2787	−0.2464	0.6573	−0.0514	−0.0267	0.247	0.291	0.178
56	2630	0.798	0.1733	−0.6874	0.5712	0.3320	−0.1746	0.821	−0.248	0.033

Adding Factor	Chi-Square* Change	d.f.	p	Percent of Variance				Factor Correlations		
				1	2	3		1	2	3
2	93.844	37	<.001	50.3015	3.4077	1.59560	1	1.000		
3	85.050	36	<.001				2	0.735	1.000	
							3	0.805	0.793	1.000

*Assumed design effect = 2.

TABLE 5

ASVAB

ITEM ATTEMPTS, FACILITIES, GUESSING PARAMETERS VALUES, STANDARD DIFFICULTIES, AND FACTOR LOADINGS

ARITHMETIC REASONING-FORM 1 (N =2848)

Item	Attempts	Facility	Chance	Intercept	Principal Factors		Promax Factors	
					1	2	1	2
4	2827	0.452	0.2382	0.5920	0.7857	0.0608	0.416	0.413
5	2842	0.808	0.1859	−0.7231	0.6989	0.1583	0.207	0.539
8	2845	0.898	0.1091	−1.2106	0.6482	−0.1628	0.677	−0.011
9	2832	0.608	0.1773	−0.0514	0.6669	−0.1252	0.631	0.058
11	2842	0.775	0.1110	−0.6648	0.6451	−0.1416	0.642	0.022
12	2833	0.443	0.1809	0.4760	0.7354	0.2150	0.142	0.647
14	2816	0.465	0.1671	0.3784	0.6994	0.0117	0.437	0.297
15	2845	0.896	0.1882	−1.1518	0.6779	0.3706	−0.140	0.881
16	2840	0.855	0.1214	−0.9772	0.7309	0.1997	0.163	0.620
17	2843	0.792	0.1916	−0.6600	0.7369	0.2880	0.028	0.768
18	2840	0.731	0.1109	−0.5182	.0.8082	0.2242	0.175	0.691
20	2822	0.579	0.2562	0.1820	0.8101	−0.0553	0.614	0.230
22	2838	0.668	0.0887	−0.3459	0.4211	−0.1050	0.439	−0.006
23	2835	0.486	0.1911	0.3518	0.8300	−0.0613	0.637	0.228
24	2834	0.652	0.0949	−0.2868	0.8014	−0.1000	0.679	0.153
25	2828	0.344	0.1203	0.6659	0.7576	−0.1533	0.734	0.048
26	2832	0.638	0.2302	−0.0677	0.7604	−0.1913	0.795	−0.014
27	2814	0.471	0.2047	0.4414	0.7640	0.0048	0.490	0.311
28	2788	0.295	0.1558	0.9946	0.8432	−0.1094	0.721	0.154
29	2823	0.556	0.1877	0.1270	0.7881	−0.0402	0.576	0.247
30	2823	0.488	0.1514	0.2602	0.8319	−0.1486	0.775	0.085
31	2815	0.406	0.2217	0.7420	0.8288	0.0313	0.491	0.381
32	2824	0.913	0.1595	−1.2585	0.5883	0.0475	0.309	0.312
34	2808	0.849	0.2357	−0.8428	0.7699	−0.2119	0.834	−0.044

Adding Factor	Chi-square* Change	d.f.	p	Percent of Variance			Factor Correlations	
				1	2		1	2
2	96.793	23	<.001	54.8230	2.5814	1	1.000	
3	25.387	22	.279			2	0.808	1.000

*Assumed design effect = 2.

TABLE 6

ASVAB
ITEM ATTEMPTS, FACILITIES, GUESSING PARAMETER VALUES, STANDARD DIFFICULTIES, AND FACTOR LOADINGS
ARITHMETIC REASONING-FORM 3 (N = 2768)

Item	Attempts	Facility	Chance	Intercept	Principal Factors		Promax Factors	
					1	2	1	2
1	2766	0.886	0.1398	−1.1064	0.3965	0.2016	−0.069	0.496
3	2747	0.316	0.1314	0.8212	0.6728	0.0349	0.328	0.388
4	2765	0.360	0.0635	0.4954	0.7361	−0.1614	0.649	0.130
5	2766	0.884	0.1499	−1.0875	0.4410	0.1718	−0.001	0.474
6	2755	0.439	0.0833	0.3061	0.7381	−0.1165	0.585	0.198
7	2759	0.825	0.1756	−0.7846	0.6120	−0.0649	0.439	0.211
8	2765	0.492	0.1268	0.2308	0.7807	−0.0389	0.496	0.333
9	2767	0.889	0.1273	−1.1361	0.5646	0.1314	0.127	0.476
13	2755	0.233	0.1389	1.2519	0.8386	−0.0416	0.533	0.358
14	2764	0.315	0.0450	0.6032	0.8772	−0.2282	0.825	0.102
17	2765	0.765	0.1637	−0.5683	0.7353	−0.0274	0.454	0.328
18	2757	0.566	0.0763	−0.0514	0.8178	−0.0167	0.485	0.385
19	2762	0.588	0.1084	−0.0766	0.7275	−0.0742	0.517	0.255
20	2756	0.526	0.2144	0.2864	0.6838	0.0356	0.333	0.395
21	2761	0.823	0.1127	−0.8292	0.5140	0.2185	−0.028	0.579
24	2741	0.548	0.2669	0.3157	0.8975	0.0772	0.393	0.563
26	2763	0.609	0.4443	0.5857	0.8434	−0.1438	0.684	0.210
27	2739	0.397	0.1350	0.5504	0.8638	0.0102	0.472	0.447
28	2746	0.424	0.2408	0.7351	0.8005	−0.1174	0.621	0.227
29	2753	0.416	0.3176	1.1090	0.8958	0.0242	0.469	0.484
30	2739	0.480	0.2008	0.4174	0.8114	−0.0360	0.509	0.353
33	2732	0.497	0.1001	0.1750	0.8699	0.0990	0.346	0.581
34	2743	0.915	0.1465	−1.2765	0.6174	0.3139	−0.108	0.772
35	2719	0.726	0.1072	−0.4908	0.5824	0.1243	0.148	0.475
Adding Factor	Chi-square* Change	d.f.	p.	Percent of Variance			Factor Correlations	
				1	2		1	2
2	73.475	23	<.001	54.0784	1.7065	1	1.000	
3	18.839	22	.655			2	0.767	1.000

*Assumed design effect = 2.

TABLE 7

ASVAB
ITEM ATTEMPTS, FACILITIES, GUESSING PARAMETER VALUES,
STANDARD DIFFICULTIES, AND FACTOR LOADINGS
ARITHMETIC REASONING-FORM 5 ($N = 2673$)

Item	Attempts	Facility	Chance	Intercept	Principal Factors		Promax Factors	
					1	2	1	2
1	2652	0.539	0.1588	0.1349	0.7377	0.0181	0.388	0.404
3	2662	0.660	0.2220	−0.1471	0.7619	−0.0349	0.326	0.490
4	2657	0.741	0.2354	−0.4038	0.7367	−0.0129	0.344	0.445
6	2664	0.831	0.1758	−0.8221	0.7742	−0.0583	0.300	0.529
7	2663	0.735	0.1251	−0.5057	0.7512	−0.1254	0.195	0.607
8	2666	0.655	0.1471	−0.2334	0.7147	−0.0768	0.244	0.519
9	2659	0.294	0.1897	1.1558	0.8822	0.0361	0.484	0.463
12	2673	0.899	0.1139	−1.2148	0.4904	−0.2072	−0.048	0.567
14	2667	0.300	0.0596	0.6658	0.8325	0.1732	0.651	0.248
15	2669	0.898	0.1235	−1.1944	0.5711	−0.2497	−0.067	0.671
16	2645	0.557	0.2818	0.3164	0.8172	0.0918	0.530	0.350
17	2665	0.728	0.2455	−0.3535	0.7103	−0.0062	0.341	0.421
18	2657	0.751	0.2665	−0.4037	0.7454	0.0139	0.386	0.414
20	2630	0.365	0.1301	0.6253	0.8315	−0.1350	0.221	0.666
21	2664	0.913	0.1498	−1.2655	0.6017	−0.2529	−0.057	0.693
23	2663	0.551	0.2080	0.1718	0.7637	0.3039	0.800	0.030
27	2635	0.097	0.0442	1.5712	0.8999	0.0157	0.465	0.501
28	2650	0.225	0.0245	0.8257	0.6917	−0.0199	0.313	0.429
29	2655	0.674	0.1444	−0.2962	0.6132	0.1841	0.558	0.106
31	2637	0.281	0.1613	1.0727	0.8655	0.0698	0.523	0.408
33	2654	0.728	0.1325	−0.4848	0.5926	0.1211	0.460	0.179
34	2633	0.408	0.1915	0.6411	0.8870	0.0917	0.564	0.390
35	2634	0.915	0.1442	−1.2891	0.4730	−0.1910	−0.034	0.534

Adding Factor	Chi-square* Change	d.f.	p.	Percent of Variance		Factor Correlations		
				1	2		1	2
2	39.557	22	.012	54.4329	1.9366	1	1.000	
3	25.909	21	.210			2	0.737	1.000

*Assumed design effect = 2.

TABLE 8

ASVAB

ITEM ATTEMPTS, FACILITIES, GUESSING PARAMETER VALUES, STANDARD DIFFICULTIES, AND FACTOR LOADINGS

WORD KNOWLEDGE-FORM 1 (N = 2840)

Item	Attempts	Facility	Chance	Intercept	Principal Factors 1	Principal Factors 2	Promax Factors 1	Promax Factors 2
1	2835	0.663	0.2804	−0.0814	0.8145	−0.2255	0.799	0.055
3	2826	0.181	0.1282	1.5346	0.8316	0.1318	0.194	0.674
4	2835	0.266	0.1603	1.1349	0.7532	0.0734	0.255	0.532
5	2826	0.161	0.0908	1.4476	0.8403	−0.2363	0.830	0.051
7	2833	0.293	0.0786	0.7250	0.8752	−0.0726	0.567	0.349
9	2836	0.377	0.1316	0.5751	0.8193	−0.0726	0.539	0.319
10	2837	0.880	0.1128	−1.1177	0.7298	0.1831	0.054	0.707
13	2840	0.892	0.1548	−1.1603	0.6071	0.3721	−0.332	0.963
15	2824	0.312	0.2455	1.3426	0.8264	0.0926	0.259	0.604
21	2835	0.899	0.1301	−1.2061	0.6460	−0.0286	0.376	0.300
28	2839	0.792	0.1883	−0.6621	0.7650	0.0141	0.362	0.437
30	2839	0.902	0.1340	−1.2303	0.6767	0.0689	0.224	0.483
34	2837	0.860	0.1252	−1.0105	0.7681	0.0743	0.261	0.542
35	2834	0.551	0.1464	0.0657	0.8271	−0.1281	0.638	0.228
37	2818	0.183	0.1128	1.3938	0.8647	0.1468	0.185	0.718
42	2827	0.628	0.1074	−0.1976	0.8654	−0.1095	0.625	0.281
43	2834	0.888	0.1708	−1.1117	0.6183	0.0607	0.208	0.438
44	2823	0.266	0.0618	0.7819	0.7648	-0.0062	0.397	0.402
45	2833	0.778	0.1890	−0.5990	0.8625	−0.0202	0.470	0.431
46	2815	0.175	0.1393	1.7162	0.5599	0.1632	0.003	0.581
47	2834	0.900	0.1424	−1.2057	0.6654	0.0934	0.176	0.519
48	2833	0.893	0.2747	−1.0635	0.8019	0.1046	0.226	0.612
49	2832	0.734	0.2012	−0.4300	0.7472	0.0122	0.357	0.424
51	2836	0.871	0.1280	−1.0625	0.7156	0.3152	− 0.179	0.924
54	2812	0.443	0.1987	0.5188	0.8532	−0.0793	0.567	0.326
58	2825	0.692	0.2690	−0.1857	0.7482	0.0773	0.245	0.536
59	2824	0.307	0.2318	1.3322	0.8152	−0.3336	0.985	0.129
61	2818	0.417	0.3174	1.0572	0.8081	0.1167	0.208	0.636
69	2803	0.306	0.1728	0.9988	0.5914	−0.0751	0.428	0.191
71	2822	0.893	0.0955	−1.1907	0.7234	0.1767	0.062	0.692
73	2821	0.653	0.1676	−0.1978	0.8475	−0.1112	0.619	0.268
74	2816	0.743	0.0925	−0.5685	0.6339	0.1454	0.071	0.591
77	2815	0.610	0.1852	−0.0399	0.8061	−0.1549	0.673	0.171
79	2805	0.507	0.2533	0.4071	0.8338	−0.2424	0.838	0.037
81	2794	0.677	0.2595	−0.1368	0.8739	−0.1339	0.672	0.244
85	2792	0.784	0.2980	−0.4920	0.8021	−0.0341	0.464	0.375
86	2746	0.345	0.2301	1.0653	0.8485	−0.0328	0.485	0.402

Adding Factor	Chi-square* Change	d.f.	p	Percent of Variance 1	Percent of Variance 2	Factor Correlations	1	2
2	157.332	36	<.001	59.8158	2.2762	1	1.000	
3	48.774	35	.061			2	0.829	1.000

*Assumed design effect = 2.

TABLE 9

ASVAB

ITEM ATTEMPTS, FACILITIES, GUESSING PARAMETER VALUES, STANDARD DIFFICULTIES, AND FACTOR LOADINGS

WORD KNOWLEDGE-FORM 2 ($N = 2655$)

Item	Attempts	Facility	Chance	Intercept	Principal Factor 1	Principal Factor 2	Promax Factors 1	Promax Factors 2
1	2635	0.373	0.2936	1.2523	0.8710	−0.1192	0.645	0.259
2	2651	0.332	0.0496	0.5507	0.8188	0.1078	0.176	0.668
3	2637	0.675	0.2575	−0.1518	0.7955	−0.0242	0.423	0.400
4	2639	0.326	0.1114	0.7152	0.8638	−0.0068	0.422	0.472
5	2648	0.781	0.2520	−0.5613	0.7780	0.1247	0.124	0.678
7	2636	0.457	0.1117	0.3037	0.8438	0.1277	0.149	0.721
9	2650	0.831	0.2095	−0.8219	0.7256	0.0897	0.167	0.581
10	2648	0.781	0.1872	−0.6301	0.5862	0.0280	0.222	0.384
14	2654	0.831	0.3802	−0.6209	0.6008	0.0460	0.194	0.426
17	2639	0.158	0.0925	1.4519	0.8349	0.0037	0.387	0.476
20	2626	0.442	0.3600	1.1726	0.7924	0.0140	0.347	0.472
23	2640	0.581	0.1082	−0.0805	0.7778	−0.2098	0.778	0.031
24	2653	0.903	0.2417	−1.1793	0.7093	0.0194	0.297	0.436
25	2647	0.338	0.1822	0.8900	0.8732	0.0361	0.342	0.560
29	2649	0.408	0.3242	1.1568	0.7744	0.3183	−0.257	1.050
30	2643	0.479	0.2135	0.4163	0.8046	−0.1332	0.641	0.194
32	2649	0.854	0.1276	−1.0077	0.8165	−0.0422	0.469	0.377
34	2646	0.300	0.1858	1.0935	0.7905	0.0466	0.283	0.534
37	2644	0.712	0.2310	−0.3229	0.7959	0.1794	0.025	0.794
39	2649	0.813	0.1735	−0.7785	0.7393	0.2448	−0.129	0.888
40	2653	0.341	0.1754	0.8369	0.7724	−0.1142	0.589	0.213
41	2640	0.823	0.2039	−0.7887	0.7951	0.0692	0.241	0.580
42	2650	0.683	0.1142	−0.3780	0.7952	−0.1154	0.602	0.224
43	2643	0.713	0.1268	−0.4501	0.8227	0.1882	0.021	0.826
44	2644	0.748	0.3939	−0.1970	0.8574	−0.2326	0.860	0.032
46	2647	0.851	0.2035	−0.9165	0.7033	0.1259	0.086	0.638
47	2642	0.642	0.1802	−0.1574	0.8058	−0.3416	1.049	−0.207
50	2649	0.699	0.2353	−0.2613	0.8899	−0.1583	0.730	0.194
51	2649	0.749	0.0990	−0.6094	0.8046	0.0021	0.376	0.456
52	2647	0.848	0.1905	−0.9036	0.5628	0.0293	0.209	0.373
54	2641	0.691	0.1479	−0.3572	0.7628	0.0629	0.237	0.550
56	2649	0.915	0.1574	−1.3061	0.5784	−0.0104	0.294	0.305
58	2634	0.364	0.2935	1.2980	0.7790	0.0200	0.329	0.476
59	2639	0.921	0.1934	−1.3114	0.6017	0.0877	0.113	0.508
60	2637	0.123	0.0736	1.5979	0.7382	0.0415	0.268	0.495
62	2632	0.198	0.1171	1.3434	0.6611	−0.0669	0.443	0.242
63	2623	0.315	0.2741	1.6240	0.7759	−0.1873	0.733	0.074
64	2625	0.309	0.2505	1.4204	0.6546	−0.0933	0.492	0.187
66	2640	0.917	0.3851	−1.1458	0.7775	0.0460	0.278	0.526
67	2641	0.277	0.0393	0.6875	0.7208	0.0148	0.312	0.434
69	2640	0.569	0.1180	−0.0277	0.6650	0.1622	−0.003	0.687
70	2634	0.640	0.2443	−0.0583	0.7828	−0.0627	0.493	0.319
73	2640	0.917	0.1988	−1.2652	0.3282	0.0756	0.007	0.330
76	2634	0.555	0.2502	0.2464	0.8241	−0.0358	0.460	0.394
77	2634	0.921	0.1660	−1.3476	0.6873	−0.0132	0.351	0.361
78	2626	0.564	0.3049	0.3335	0.8088	−0.1169	0.611	0.228
79	2635	0.669	0.2202	−0.1857	0.8690	−0.0449	0.499	0.401
82	2599	0.312	0.1705	0.9533	0.3016	−0.0394	0.220	0.093
84	2622	0.883	0.2354	−1.0572	0.7932	−0.0080	0.391	0.430
86	2607	0.843	0.1303	−0.9332	0.7381	0.0190	0.312	0.451

Adding Factor	Chi-square* Change	d.f.	p	Percent of Variance 1	Percent of Variance 2	Factor Correlations	1	2
2	258.085	49	<.001	56.9080	1.45802	1	1.000	
3	68.350	48	.028			2	0.868	1.000

*Assumed design effect = 2.

TABLE 10
ASVAB
ITEM ATTEMPTS, FACILITIES, GUESSING PARAMETER VALUES,
STANDARD DIFFICULTIES, AND FACTOR LOADINGS
WORD KNOWLEDGE-FORM 3 (N = 2676)

Item	Attempts	Facility	Chance	Intercept	Principal Factors		Promax Factors	
					1	2	1	2
1	2675	0.860	0.1691	−0.5739	0.5496	−0.1467	0.019	0.553
2	2660	0.348	0.2206	0.9890	0.6748	0.0528	0.516	0.401
3	2673	0.917	0.2479	−1.2445	0.5672	−0.0193	0.244	0.350
4	2673	0.774	0.4445	−0.2190	0.6682	0.0429	0.491	0.409
6	2659	0.437	0.2450	0.6524	0.8957	0.1731	0.730	0.211
7	2661	0.474	0.2280	0.4867	0.8638	0.0735	0.548	0.360
8	2672	0.260	0.2063	1.4592	0.3965	−0.1341	−0.034	0.446
9	2668	0.151	0.0382	1.1702	0.7376	−0.1009	0.188	0.582
11	2669	0.278	0.0794	0.7668	0.8898	−0.0128	0.397	0.503
12	2675	0.838	0.2019	−0.8270	0.3798	0.0424	0.287	0.141
13	2672	0.857	0.2517	−0.8748	0.7096	−0.1240	0.138	0.605
14	2672	0.900	0.1714	−1.1861	0.4961	−0.0706	0.122	0.396
15	2666	0.300	0.1253	0.8245	0.8611	0.0694	0.537	0.366
16	2657	0.302	0.1846	1.0546	0.8665	0.0958	0.585	0.325
17	2675	0.869	0.2460	−0.9562	0.5800	0.1075	0.450	0.128
20	2674	0.883	0.3819	−0.6938	0.7828	0.1922	0.693	0.099
21	2674	0.899	0.2488	−1.1338	0.7311	−0.3323	−0.208	0.966
22	2668	0.657	0.2239	−0.1517	0.7994	0.2577	0.827	0.016
26	2671	0.810	0.1882	−0.7311	0.6123	−0.0148	0.273	0.368
30	2674	0.853	0.2665	−0.8524	0.5140	0.1937	0.579	−0.037
31	2674	0.843	0.2237	−0.8409	0.3839	−0.0053	0.178	0.226
32	2674	0.921	0.1292	−1.3748	0.7031	−0.0904	0.189	0.545
33	2671	0.079	0.0144	1.4891	0.8574	−0.1565	0.152	0.742
34	2674	0.586	0.1474	−0.0427	0.3574	−0.0013	0.172	0.202
35	2671	0.419	0.1070	0.3828	0.7621	0.0963	0.535	0.265
37	2660	0.410	0.2247	0.7000	0.7743	0.0093	0.393	0.418
39	2659	0.496	0.2033	0.3366	0.7296	0.1997	0.694	0.074
41	2660	0.600	0.4236	0.4929	0.7889	−0.1282	0.167	0.656
42	2673	0.643	0.2087	−0.1220	0.7641	0.0961	0.535	0.267
45	2662	0.688	0.3354	−0.0537	0.8592	−0.0308	0.367	0.532
46	2672	0.363	0.1741	0.8212	0.6916	−0.1207	0.132	0.589
52	2667	0.867	0.1562	−1.0121	0.7422	0.0815	0.615	0.363
54	2644	0.264	0.1631	1.1739	0.8627	0.0974	0.586	0.320
56	2664	0.371	0.1403	0.6147	0.6903	0.2301	0.727	0.001
57	2672	0.932	0.1737	−1.4619	0.7722	−0.2233	−0.003	0.806
58	2672	0.874	0.1379	−1.0633	0.7660	−0.1088	0.194	0.605
59	2667	0.964	0.2100	−1.7047	0.5424	−0.1472	0.014	0.550
60	2670	0.761	0.1241	−0.6086	0.6380	−0.0084	0.295	0.369
62	2667	0.871	0.3402	−0.8693	0.6775	−0.0614	0.434	0.276
63	2662	0.491	0.1763	0.2992	0.8072	−0.0394	0.326	0.318
65	2661	0.846	0.3382	−0.6912	0.8287	−0.1410	0.163	0.698
68	2650	0.362	0.1575	0.6973	0.8057	0.2252	0.775	0.074
69	2646	0.276	0.1978	1.2864	0.4241	0.0071	0.219	0.226
70	2656	0.239	0.0771	0.9289	0.9133	0.2016	0.787	0.174
73	2647	0.405	0.0998	0.4067	0.8899	0.0495	0.517	0.415
74	2651	0.481	0.2782	0.5748	0.6951	−0.1334	0.116	0.611
76	2651	0.616	0.1589	−0.0996	0.7329	0.0439	0.432	0.337
77	2646	0.260	0.1303	1.0404	0.7637	−0.0446	0.296	0.502
78	2655	0.765	0.3074	−0.4088	0.6334	−0.0785	0.175	0.486
79	2656	0.901	0.2086	−1.1384	0.6304	−0.2548	−0.125	0.780
81	2644	0.201	0.2942	−1.0773	0.8106	−0.0541	0.303	0.544
82	2642	0.919	0.2179	−1.2825	0.8080	0.0185	0.425	0.421
83	2643	0.882	0.2091	−1.0458	0.4736	−0.0832	0.089	0.404
84	2619	0.325	0.2013	1.0121	0.7568	−0.0596	0.267	0.533
86	2606	0.217	0.2821	−1.2176	0.7824	−0.0887	0.231	0.586

Adding Factor	Chi-square* Change	d.f.	p	Percent of Variance			Factor Correlations	
				1	2		1	2
2	290.250	54	< .001	52.4404	1.6216	1	1.000	
3	133.219	53	< .001			2	.824	1.000

*Assumed design effect = 2.

TABLE 11

ASVAB

ITEM ATTEMPTS, FACILITIES, GUESSING PARAMETER VALUES, STANDARD DIFFICULTIES, AND FACTOR LOADINGS

PARAGRAPH COMPREHENSION-FORM 1 (N = 2952)

Item	Attempts	Facility	Chance	Intercept	Principal Factor
1	2952	0.907	0.1676	−1.2244	0.6015
3	2944	0.392	0.1499	0.5670	0.4283
5	2943	0.489	0.1899	0.3397	0.7320
6	2950	0.914	0.1433	−1.2833	0.5774
7	2952	0.919	0.1293	−1.3379	0.7477
8	2951	0.231	0.1038	1.0706	0.6219
9	2948	0.695	0.2018	−0.3007	0.7823
11	2950	0.895	0.1451	−1.1666	0.5207
12	2947	0.749	0.0874	−0.6002	0.6561
13	2948	0.694	0.1072	−0.4064	0.6892
14	2948	0.471	0.1481	0.3081	0.6741
15	2944	0.611	0.3122	0.1663	0.6559
16	2946	0.367	0.1168	0.5713	0.5440
17	2946	0.902	0.1315	−1.2151	0.6249
20	2947	0.303	0.1074	0.7727	0.6993
22	2941	0.271	0.1997	1.3701	0.8456
23	2937	0.610	0.1408	−0.1123	0.7031
24	2942	0.920	0.1942	−1.2987	0.6845
27	2931	0.397	0.1515	0.5591	0.6877
28	2928	0.619	0.0971	−0.1945	0.6419
29	2926	0.846	0.1936	−0.8735	0.7106
30	2925	0.917	0.2286	−1.2444	0.8381
31	2912	0.221	0.1259	1.2340	0.7647
32	2903	0.520	0.2626	0.4022	0.7880
33	2883	0.909	0.1527	−1.2407	0.5744
Adding Factor	Chi-square[*] Change	d.f.	p		Percent of Variance
2	35.249	24	.065		46.0604

[*] Assumed design effect = 2.

TABLE 12

ASVAB

ITEM ATTEMPTS, FACILITIES, GUESSING PARAMETER VALUES, STANDARD DIFFICULTIES, AND FACTOR LOADINGS

PARAGRAPH COMPREHENSION-FORM 3 ($N = 2724$)

Item	Attempts	Facility	Chance	Intercept	Principal Factor
1	2719	0.237	0.1800	1.5192	0.6786
2	2718	0.424	0.1138	0.3982	0.5716
3	2721	0.503	0.2405	0.4155	0.6851
4	2718	0.374	0.1995	0.8003	0.5900
5	2721	0.758	0.0988	−0.6141	0.6145
9	2723	0.293	0.1749	1.0939	0.6452
10	2721	0.556	0.1997	0.1505	0.6623
11	2724	0.886	0.1850	−1.0878	0.5313
13	2722	0.911	0.1410	−1.2650	0.5495
14	2724	0.767	0.1778	−0.5731	0.6511
15	2724	0.897	0.0988	−1.2238	0.7752
16	2720	0.766	0.1502	−0.5937	0.7766
18	2723	0.793	0.1039	−0.7389	0.7111
19	2721	0.878	0.1483	−1.0748	0.7698
20	2718	0.531	0.1818	0.2082	0.8240
21	2715	0.277	0.0663	0.7666	0.4920
22	2717	0.719	0.1247	−0.4605	0.7319
23	2714	0.446	0.3301	0.9891	0.7462
24	2711	0.858	0.1591	−0.9568	0.6365
25	2706	0.293	0.1008	0.8235	0.8596
26	2702	0.445	0.2274	0.6153	0.7704
27	2705	0.708	0.1112	−0.4347	0.7162
28	2704	0.397	0.1563	0.5854	0.6544
29	2698	0.911	0.1752	−1.2396	0.6379
30	2685	0.440	0.1189	0.3715	0.7789
31	2668	0.898	0.1655	−1 1657	0.6563
32	2656	0.215	0.1161	1.2519	0.8387
33	2629	0.351	0.1354	0.7198	0.8451
Adding Factor	Chi-square* Change	d.f.	p.		Percent of Variance
2	50.863	27	<.004		48.9357

* Assumed design effect = 2.

TABLE 13

ASVAB
ITEM ATTEMPTS, FACILITIES, GUESSING PARAMETER VALUES, STANDARD DIFFICULTIES, AND FACTOR LOADINGS
PARAGRAPH COMPREHENSION-FORM 5 ($N = 2726$)

Item	Attempts	Facility	Chance	Intercept	Principal Factor
1	2725	0.857	0.1758	−0.9502	0.4068
2	2720	0.647	0.1344	−0.2417	0.6190
3	2724	0.859	0.1839	−0.9639	0.6392
5	2726	0.860	0.1928	−0.9548	0.4866
6	2720	0.237	0.1209	1.1033	0.8215
8	2722	0.108	0.0555	1.5822	0.7246
9	2726	0.553	0.0818	−0.0445	0.7359
11	2724	0.697	0.1868	−0.3370	0.6608
13	2726	0.901	0.2706	−1.1313	0.7574
14	2724	0.327	0.0547	0.5506	0.7191
15	2725	0.910	0.1507	−1.2765	0.5824
16	2720	0.455	0.3163	0.8350	0.6815
17	2722	0.584	0.1865	0.0206	0.7833
18	2721	0.910	0.1768	−1.2432	0.4877
19	2720	0.416	0.2736	0.8499	0.3877
20	2724	0.903	0.1139	−1.2532	0.5452
21	2722	0.810	0.1251	−0.7962	0.5501
22	2719	0.914	0.1214	−1.3120	0.6089
23	2720	0.651	0.1331	−0.2586	0.7447
25	2719	0.716	0.2306	−0.3440	0.7637
26	2716	0.823	0.3768	−0.5779	0.7140
27	2707	0.208	0.0841	1.1030	0.0222
28	2709	0.575	0.1428	−0.0177	0.7399
29	2707	0.905	0.1415	−1.2403	0.5395
30	2706	0.900	0.1944	−1.1742	0.6315
31	2699	0.558	0.1604	0.0613	0.6225
32	2692	0.627	0.1400	−0.1724	0.6645
33	2678	0.841	0.1404	−0.9096	0.6694
Adding Factor	Chi-square* Change	d.f.	p		Percent of Variance
2	64.032	27	< .001		40.7191

*Assumed design effect = 2

TABLE 14

ASVAB
ITEM ATTEMPTS, FACILITIES, GUESSING PARAMETER VALUES
STANDARD DIFFICULTIES, AND FACTOR LOADINGS
AUTOMOTIVE INFORMATION-FORM 1 ($N = 2934$)

Item	Attempts	Facility	Chance	Intercept	Principal Factor
1	2932	0.772	0.1509	-0.6531	0.7526
2	2926	0.437	0.1298	0.4469	0.8670
3	2930	0.857	0.1070	-1.0263	0.5771
4	2928	0.807	0.3555	-0.5491	0.6999
5	2931	0.536	0.0569	-0.0085	0.5179
7	2928	0.510	0.0924	0.1194	0.5665
8	2930	0.817	0.0931	-0.8732	0.6571
9	2929	0.553	0.2613	0.3038	0.7734
10	2927	0.560	0.3104	0.3912	0.6538
11	2926	0.318	0.2193	1.2919	0.8511
12	2923	0.242	0.1645	1.4416	0.7358
13	2922	0.530	0.1619	0.1891	0.8183
14	2931	0.894	0.2042	-1.1597	0.6229
15	2927	0.184	0.0454	1.1670	0.8098
17	2930	0.431	0.0600	0.2868	0.4822
20	2928	0.780	0.1749	-0.6633	0.8150
21	2928	0.316	0.0918	0.7669	0.8164
23	2928	0.777	0.1992	-0.5879	0.3491
24	2926	0.174	0.0573	1.3049	0.8732
25	2930	0.737	0.1928	-0.4708	0.7448
28	2932	0.331	0.0458	0.5654	0.5825
29	2933	0.909	0.1076	-1.3161	0.5280
30	2930	0.871	0.4185	-0.8105	0.7466
32	2924	0.474	0.2062	0.4704	0.7491
33	2921	0.250	0.1149	1.1062	0.6672
34	2932	0.275	0.0897	0.3082	0.7418
35	2924	0.531	0.4309	1.0429	0.7842
37	2926	0.591	0.2676	0.1714	0.6471
38	2922	0.582	0.3292	0.3636	0.8206
39	2928	0.633	0.2859	1.0758	0.8981
41	2927	0.603	0.1671	-0.0443	0.8331
42	2928	0.921	0.2164	-1.2975	0.4362
44	2923	0.441	0.3169	1.0066	0.7869
45	2923	0.371	0.2591	1.1326	0.7098
46	2930	0.851	0.1263	1.0123	0.7344
47	2919	0.130	0.1141	2.3058	0.8650
49	2922	0.672	0.4432	0.2722	0.8346
50	2925	0.914	0.1825	1.2946	0.5366
51	2915	0.355	0.0909	0.6164	0.7719
53	2920	0.889	0.1772	1.1602	0.6644
56	2914	0.736	0.1124	-0.5540	0.7714
57	2910	0.862	0.3530	0.8367	0.7876
58	2907	0.329	0.1956	1.0781	0.7908
60	2912	0.339	0.2009	1.0545	0.8168

Adding Factor	Chi-square* Change	Df	p		Percent of Variance
2	316.68	43	< .001		52.8158

*Assumed design effect = 2

TABLE 15

ASVAB

ITEM ATTEMPTS, FACILITIES, GUESSING PARAMETER VALUES, STANDARD DIFFICULTIES, AND FACTOR LOADINGS

AUTOMOTIVE INFORMATION-FORM 2 ($N = 2814$)

Item	Attempts	Facility	Chance	Intercept	Principal Factor
1	2803	0.357	0.1745	0.8009	0.6875
2	2811	0.812	0.2299	−0.7392	0.7917
4	2806	0.501	0.0645	0.0845	0.5011
5	2804	0.342	0.2458	1.2369	0.8016
6	2809	0.269	0.1343	1.0734	0.8344
7	2813	0.523	0.0711	0.0323	0.6182
8	2813	0.920	0.1642	−1.3567	0.6055
9	2813	0.758	0.4996	−0.0111	0.5757
12	2810	0.150	0.0672	1.4106	0.7846
13	2810	0.810	0.2179	−0.7031	0.2981
15	2812	0.678	0.2242	−0.2293	0.8502
16	2809	0.517	0.2306	0.3430	0.7842
18	2814	0.196	0.1096	1.3572	0.6839
19	2814	0.921	0.5000	−1.0864	0.8596
20	2809	0.224	0.1155	1.2154	0.6847
22	2814	0.807	0.1263	−0.8063	0.6505
24	2812	0.643	0.4990	0.6375	0.7331
25	2808	0.896	0.1676	−1.1658	0.4453
26	2802	0.254	0.1510	1.2418	0.8049
27	2810	·0.473	0.1296	0.2937	0.8528
28	2812	0.883	0.1397	−1.1382	0.5715
29	2809	0.712	0.1101	−0.4804	0.7028
32	2806	0.635	0.2034	−0.1105	0.7587
33	2808	0.621	0.0894	−0.2208	0.6768
36	2805	0.570	0.1786	0.0660	0.8172
37	2811	0.915	0.1736	−1.2781	0.3263
38	2808	0.419	0.1622	0.5301	0.7409
39	2797	0.550	0.0675	−0.0417	0.6850
41	2805	0.326	0.2694	1.4882	0.6936
42	2811	0.853	0.2345	−0.9259	0.7434
43	2802	0.326	0.1546	0.8757	0.7142
44	2799	0.282	0.0879	0.8429	0.7298
46	2809	0.764	0.1372	−0.6266	0.6403
47	2810	0.657	0.2143	−0.1664	0.8571
49	2798	0.223	0.1571	1.5159	0.8281
50	2809	0.859	0.1577	−0.9842	0.4392
52	2809	0.718	0.1058	−0.5137	0.7782
55	2798	0.469	0.1281	0.2973	0.7520
57	2792	0.146	0.0658	1.4331	0.7354
59	2799	0.832	0.3719	−0.6517	0.7187
60	2794	0.586	0.2644	0.1647	0.6586
Adding Factor	Chi-square* Change	d.f.	p		Percent of Variance
2	195.154	40	< .001		49.8295

* Assumed design effect = 2.

TABLE 16

ASVAB
ITEM ATTEMPTS, FACILITIES, GUESSING PARAMETER VALUES, STANDARD DIFFICULTIES, AND FACTOR LOADINGS
AUTOMOTIVE INFORMATION-FORM 3 (N = 2720)

Item	Attempts	Facility	Chance	Intercept	Principal Factors
1	2718	0.388	0.1441	0.5922	0.7996
2	2705	0.308	0.1339	0.8401	0.3264
3	2708	0.653	0.1080	−0.3096	0.5965
4	2708	0.304	0.0822	0.7246	0.7406
6	2714	0.649	0.1250	−0.3083	0.7971
8	2719	0.901	0.1408	−1.2880	0.7245
9	2719	0.798	0.1507	−0.7501	0.4934
10	2714	0.289	0.2000	1.3735	0.8701
11	2705	0.187	0.1741	2.1685	0.3610
12	2710	0.272	0.1803	1.2965	0.7411
13	2711	0.192	0.1332	1.6115	0.8024
14	2706	0.406	0.2506	0.8676	0.7830
15	2718	0.851	0.2607	−0.8465	0.2351
16	2712	0.141	0.0595	1.4247	0.6793
17	2717	0.903	0.2052	−1.2010	0.4464
18	2718	0.886	0.1890	−1.1352	0.5748
21	2706	0.231	0.1835	1.6987	0.7777
22	2717	0.641	0.1152	−0.2915	0.7424
23	2717	0.725	0.4410	−0.0605	0.8279
24	2713	0.572	0.1808	0.0189	0.8092
25	2706	0.558	0.2474	0.2083	0.6668
26	2714	0.128	0.0669	1.6166	0.7850
27	2710	0.451	0.1718	0.4172	0.7745
29	2716	0.596	0.2659	0.0952	0.7692
30	2711	0.148	0.0805	1.5455	0.7568
31	2711	0.590	0.1457	−0.1188	0.8856
33	2719	0.878	0.1257	−1.1098	0.3653
34	2718	0.525	0.3328	0.5785	0.7713
35	2712	0.660	0.2935	−0.0783	0.7316
36	2712	0.366	0.0932	0.5395	0.8790
37	2710	0.485	0.1365	0.2208	0.8615
38	2714	0.882	0.2927	−1.0187	0.6057
40	2712	0.254	0.1017	1.0025	0.7377
41	2717	0.617	0.0476	−0.2900	0.6798
42	2718	0.711	0.2718	−0.3138	0.7328
43	2715	0.726	0.4112	−0.1420	0.8502
44	2706	0.432	0.2290	0.6379	0.5234
45	2713	0.686	0.3264	−0.0978	0.3911
46	2704	0.272	0.0906	0.8833	0.7632
48	2709	0.474	0.1482	0.2945	0.7628
49	2718	0.607	0.3262	0.1957	0.7056
50	2717	0.907	0.1787	−1.2819	0.6465
52	2704	0.365	0.1111	0.5839	0.7865
53	2710	0.367	0.0722	0.4758	0.6896
54	2707	0.625	0.2657	0.0032	0.7608
55	2705	0.824	0.1835	−0.8418	0.6815
56	2706	0.908	0.1287	−1.3030	0.5666
57	2703	0.425	0.0710	0.2910	0.7601
Adding Factor	Chi-square* Change	df	p		Percent of Variance
2	244.263	47	< .001		49.6961

* Assumed design effect = 2.

TABLE 17

ASVAB
ITEM ATTEMPTS, FACILITIES, GUESSING PARAMETER VALUES, STANDARD DIFFICULTIES, AND FACTOR LOADINGS
SHOP INFORMATION-FORM 1 (N = 2926)

Item	Attempts	Facility	Chance	Intercept	Principal Factors		Promax Factors	
					1	2	1	2
2	2925	0.831	0.1719	−0.8458	-0.6445	−0.2342	−0.073	0.745
3	2913	0.221	0.1505	1.3855	−0.5515	−0.2362	−0.123	0.698
4	2922	0.688	0.1842	−0.3055	−0.5898	−0.0340	0.240	0.377
5	2920	0.802	0.2549	−0.6422	−0.7130	−0.1792	0.055	0.689
6	2924	0.452	0.0857	0.2496	−0.5054	0.0929	0.412	0.118
7	2921	0.593	0.0513	−0.1850	−0.7081	0.1230	0.566	0.177
8	2926	0.096	0.0720	1.9689	−0.6868	−0.3180	−0.194	0.909
9	2920	0.500	0.1126	0.1647	−0.7097	0.0896	0.510	0.234
13	2914	0.156	0.1253	1.8330	−0.7470	−0.2718	−0.085	0.864
14	2922	0.787	0.0648	−0.7773	−0.7185	0.2488	0.784	−0.029
15	2922	0.443	0.0840	0.2805	−0.7727	−0.0356	0.329	0.479
16	2918	0.719	0.4330	−0.0014	−0.7989	−0.0676	0.288	0.548
17	2924	0.915	0.1562	−1.2886	−0.5053	0.0207	0.290	0.239
19	2919	0.419	0.1062	0.3966	−0.8335	−0.0335	0.363	0.509
20	2922	0.326	0.1555	0.8541	−0.6395	0.0788	0.456	0.214
21	2923	0.854	0.3323	−0.7976	−0.6232	0.2521	0.742	−0.087
22	2911	0.260	0.0829	0.8890	−0.7287	0.1088	0.552	0.212
24	2923	0.286	0.0662	0.7311	−0.7708	−0.1454	0.142	0.663
25	2918	0.456	0.1310	0.3318	−0.7156	0.0529	0.450	0.299
26	2922	0.174	0.0667	1.2074	−0.6088	−0.1019	0.134	0.502
27	2924	0.785	0.1760	−0.6686	−0.7904	0.3850	1.052	−0.220
28	2911	0.178	0.1402	1.7378	−0.6869	−0.0771	0.215	0.503
29	2919	0.682	0.2350	−0.2142	−0.5892	−0.1453	0.050	0.565
30	2919	0.170	0.0933	1.3959	−0.7391	−0.1373	0.139	0.633
31	2923	0.924	0.1610	−1.3558	−0.5555	−0.1338	0.053	0.527
32	2922	0.861	0.1008	−1.0383	−0.6239	0.0425	0.386	0.267
33	2915	0.381	0.0719	0.4371	−0.6129	0.0626	0.415	0.227
35	2918	0.119	0.0691	1.6320	−0.6320	−0.0579	0.220	0.441
36	2918	0.484	0.1976	0.3873	−0.7592	0.1759	0.681	0.116
37	2918	0.707	0.2862	−0.2317	−0.7907	−0.0496	0.314	0.513
38	2918	0.400	0.3012	1.1255	−0.7371	0.0727	0.495	0.278
39	2920	0.613	0.2523	0.0425	−0.4972	0.1335	0.477	0.045
40	2923	0.240	0.0366	0.8208	−0.7525	−0.1482	0.128	0.658
41	2920	0.088	0.0357	1.6088	−0.6783	−0.0964	0.178	0.531
43	2921	0.559	0.0922	−0.0397	−0.6281	0.0996	0.486	0.173
44	2915	0.241	0.0954	0.9961	−0.4955	0.1318	0.473	0.047
45	2917	0.640	0.0524	−0.3170	−0.7190	0.1884	0.682	0.073
46	2919	0.607	0.1438	−0.1054	−0.7106	−0.1446	0.112	0.630
47	2911	0.350	0.1812	0.8409	−0.6363	−0.3064	−0.200	0.862
48	2920	0.697	0.1585	−0.3715	−0.7601	0.1454	0.630	0.167
49	2913	0.187	0.1317	1.5761	−0.7574	0.2700	0.840	−0.044
50	2910	0.217	0.1020	1.1582	−0.7356	0.0048	0.379	0.391
52	2915	0.743	0.0997	−0.5686	−0.4876	−0.0307	0.194	0.316
53	2909	0.734	0.1259	−0.5258	−0.7860	0.0818	0.535	0.289
55	2911	0.865	0.1386	−1.0137	−0.5037	−0.2118	−0.106	0.631
56	2901	0.469	0.4403	1.6364	−0.8960	0.1948	0.782	0.158
57	2874	0.522	0.1327	0.1336	−0.7256	−0.0472	0.285	0.474

Adding Factor	Chi-square* Change	d.f.	p	Percent of Variance			Factor Correlations	
				1	2		1	2
2	237.573	46	<.001	46.9183	2.5727	1	1.000	
3	88.724	45	<.001			2	0.825	1.000

*Assumed design effect = 2.

TABLE 18

ASVAB

ITEM ATTEMPTS, FACILITIES, GUESSING PARAMETER VALUES, STANDARD DIFFICULTIES, AND FACTOR LOADINGS

SHOP INFORMATION-FORM 2 (N = 2733)

Item	Attempts	Facility	Chance	Intercept	Principal Factors 1	Principal Factors 2	Promax Factors 1	Promax Factors 2
1	2723	0.548	0.0882	0.0057	0.5372	0.2387	0.714	−0.169
3	2724	0.793	0.3106	−0.5106	0.6982	0.1343	0.659	0.064
4	2730	0.561	0.1098	−0.0084	0.4193	0.2272	0.620	−0.198
5	2728	0.163	0.1041	1.5295	0.7769	−0.3234	0.008	0.835
6	2731	0.436	0.0846	0.3252	0.6477	−0.1030	0.262	0.427
7	2731	0.820	0.1955	−0.7546	0.4033	−0.0260	0.222	0.205
8	2732	0.661	0.1780	−0.2033	0.7656	−0.1654	0.243	0.576
9	2731	0.316	0.0817	0.6874	0.5938	−0.0926	0.243	0.389
10	2733	0.628	0.1116	−0.1894	0.6738	0.0708	0.545	0.157
11	2729	0.576	0.1207	−0.0147	0.7623	−0.0484	0.420	0.385
12	2725	0.375	0.1658	0.7087	0.6853	0.0344	0.497	0.221
13	2732	0.139	0.0770	1.5283	0.6974	−0.3002	−0.008	0.766
14	2730	0.563	0.1371	0.0471	0.7968	−0.0811	0.392	0.452
15	2731	0.804	0.1898	−0.6948	0.4577	0.1388	0.510	−0.040
16	2732	0.734	0.5000	0.1182	0.6035	0.0715	0.501	0.128
17	2726	0.713	0.3808	−0.0700	0.6578	0.2326	0.783	−0.111
18	2719	0.489	0.1823	0.3370	0.4687	0.0302	0.350	0.140
19	2728	0.741	0.1444	−0.5092	0.7944	−0.0101	0.499	0.336
20	2728	0.346	0.1881	0.9016	0.6688	−0.0809	0.309	0.400
21	2731	0.772	0.0623	−0.6989	0.7233	0.2568	0.863	−0.123
22	2733	0.369	0.0700	0.4907	0.6081	−0.1837	0.112	0.542
23	2729	0.454	0.1596	0.4171	0.6848	0.0123	0.463	0.256
25	2732	0.840	0.2450	−0.7996	0.5151	0.1678	0.591	−0.063
26	2728	0.627	0.1449	−0.1406	0.7338	−0.0418	0.411	0.363
27	2732	0.913	0.1423	−1.2920	0.6880	0.0241	0.483	0.238
28	2724	0.514	0.3182	0.5967	0.7180	0.1292	0.663	0.081
29	2730	0.428	0.1644	0.5175	0.7174	−0.0898	0.327	0.434
32	2718	0.325	0.2101	1.0882	0.6939	0.3246	0.947	−0.245
33	2731	0.815	0.0837	−0.8380	0.6954	0.0825	0.577	0.147
34	2725	0.590	0.2219	0.1002	0.7370	0.0665	0.580	0.190
35	2728	0.182	0.0762	1.2287	0.4851	−0.0367	0.258	0.255
36	2725	0.242	0.1053	1.0680	0.7326	−0.1006	0.320	0.458
39	2725	0.336	0.0644	0.5721	0.4745	−0.0499	0.231	0.272
40	2719	0.216	0.1699	1.5713	0.7619	−0.4418	−0.184	1.021
41	2725	0.483	0.1798	0.3568	0.6006	0.0825	0.516	0.109
42	2722	0.327	0.0660	0.6351	0.7946	−0.0599	0.423	0.417
43	2723	0.631	0.1583	−0.1351	0.5845	0.1443	0.600	0.002
44	2718	0.456	0.2768	0.7012	0.4747	0.0576	0.396	0.098
45	2725	0.477	0.1461	0.3330	0.8293	−0.0602	0.445	0.431
46	2720	0.592	0.1678	0.0176	0.8492	0.1077	0.716	0.168
47	2726	0.738	0.1936	−0.4476	0.5131	−0.3795	−0.249	0.820
48	2729	0.883	0.1604	−1.0837	0.5059	0.0933	0.471	0.053
49	2723	0.227	0.1964	1.8854	0.7646	0.2400	0.864	−0.080
50	2726	0.618	0.1469	−0.1134	0.6933	−0.3370	−0.067	0.824
51	2723	0.584	0.3033	0.2870	0.7092	−0.0152	0.436	0.310
52	2717	0.214	0.2000	2.1771	0.8227	0.0577	0.622	0.238
53	2719	0.224	0.1626	1.5166	0.6719	0.0100	0.451	0.255
55	2721	0.448	0.1335	0.3895	0.7450	−0.0229	0.448	0.337
56	2711	0.241	0.1600	1.3522	0.7232	0.1374	0.679	0.069
57	2695	0.236	0.0367	0.8536	0.6659	0.1119	0.603	0.087

Adding Factor	Chi-square* Change	d.f.	p	Percent of Variance 1	Percent of Variance 2		Factor Correlations 1	Factor Correlations 2
2	259.945	49	<.001	44.9342	2.7195	1	1.000	
3	127.941	48	<.001			2	0.800	1.000

*Assumed design effect = 2.

TABLE 19

ASVAB

ITEM ATTEMPTS, FACILITIES, GUESSING PARAMETER VALUES, STANDARD DIFFICULTIES, AND FACTOR LOADINGS

SHOP INFORMATION-FORM 3 ($N = 2685$)

Item	Attempts	Facility	Chance	Intercept	Principal Factors		Promax Factors	
					1	2	1	2
1	2675	0.228	0.1678	1.5222	0.7731	0.0900	0.366	0.459
2	2677	0.365	0.1041	0.5899	0.7748	0.3619	−0.027	0.876
4	2679	0.617	0.1139	−0.1481	0.7280	−0.0488	0.539	0.228
5	2673	0.467	0.2771	0.6846	0.7243	0.1781	0.207	0.574
7	2680	0.315	0.1648	0.9536	0.7197	−0.0732	0.569	0.187
8	2684	0.742	0.0888	−0.5671	0.6362	−0.1852	0.678	−0.019
9	2680	0.734	0.2027	−0.4135	0.7476	0.1159	0.312	0.488
11	2675	0.407	0.2614	0.8954	0.6900	0.1508	0.225	0.517
12	2678	0.379	0.3052	1.3018	0.8057	−0.1516	0.738	0.102
13	2672	0.296	0.1721	1.0807	0.7637	0.0066	0.481	0.327
14	2678	0.262	0.1957	1.4205	0.5778	−0.0666	0.468	0.138
15	2675	0.530	0.1712	0.2062	0.7209	0.0888	0.335	0.435
17	2678	0.158	0.0692	1.3250	0.5546	−0.0979	0.498	0.080
18	2679	0.393	0.0577	0.3985	0.7097	−0.1010	0.603	0.140
19	2680	0.845	0.1279	−0.9263	0.7117	−0.2027	0.752	−0.015
20	2677	0.321	0.0763	0.6577	0.6606	−0.0618	0.514	0.180
22	2669	0.300	0.1505	0.9675	0.6469	0.0283	0.375	0.312
24	2675	0.217*	0.1690	1.6252	0.8900	0.0654	0.477	0.470
25	2674	0.541	0.1618	0.1535	0.6890	0.1034	0.293	0.445
26	2679	0.447	0.2044	0.5540	0.7803	0.1750	0.248	0.592
27	2680	0.642	0.2961	0.0418	0.7944	0.2267	0.182	0.677
28	2681	0.618	0.1184	−0.1594	0.4066	−0.0757	0.371	0.053
29	2680	0.575	0.1787	0.0716	0.7530	−0.1444	0.694	0.091
30	2682	0.925	0.1085	−1.3867	0.6373	−0.1158	0.578	0.087
31	2678	0.645	0.1554	−0.1740	0.7943	−0.0701	0.612	0.223
32	2674	0.447	0.1947	0.5336	0.7073	−0.0032	0.459	0.289
33	2675	0.759	0.2294	−0.4684	0.7108	−0.0390	0.513	0.236
34	2682	0.229	0.1515	1.3625	0.7891	−0.2426	0.859	−0.044
36	2683	0.795	0.2023	−0.6544	0.4974	−0.3005	0.756	−0.254
37	2682	0.745	0.1166	−0.5443	0.5607	0.1192	0.187	0.415
38	2685	0.866	0.1754	−0.9807	0.3993	−0.0859	0.381	0.034
39	2684	0.878	0.2814	−0.9594	0.6971	0.1248	0.267	0.481
40	2678	0.389	0.2411	0.8643	0.2542	−0.0940	0.300	−0.038
41	2682	0.262	0.0645	0.8440	0.7960	−0.0404	0.570	0.269
43	2677	0.371	0.0749	0.4916	0.5670	0.0312	0.319	0.283
45	2675	0.407	0.0954	0.4252	0.6202	−0.1295	0.587	0.059
46	2673	0.624	0.2007	−0.0443	0.7421	−0.0690	0.577	0.202
48	2670	0.475	0.1351	0.3049	0.7094	−0.1568	0.684	0.054
49	2675	0.426	0.1875	0.5800	0.6791	0.4458	−0.210	0.965
50	2667	0.571	0.2321	0.1861	0.7805	0.1136	0.337	0.498
51	2669	0.551	0.2054	0.2119	0.8183	−0.0804	0.643	0.217
52	2667	0.333	0.0824	0.6186	0.4310	−0.0993	0.421	0.027
53	2661	0.217	0.1800	1.7684	0.5039	0.2997	−0.111	0.668
54	2665	0.672	0.4594	0.3186	0.6944	−0.0015	0.449	0.286
55	2664	0.766	0.1536	−0.5763	0.7065	−0.1291	0.641	0.096
56	2657	0.364	0.2580	1.1296	0.8182	0.0586	0.441	0.430
57	2641	0.905	0.1707	−1.2070	0.4027	−0.2817	0.667	−0.264

Adding Factor	Chi-square* Change	d.f.	p	Percent of Variance			Factor Correlations	
				1	2		1	2
2	272.32	46	<.001	46.8762	2.4562	1	1.000	
3	121.791	45	<.001			2	0.776	1.000

*Assumed design effect = 2.

TABLE 20

ASVAB

ITEM ATTEMPTS, FACILITIES, GUESSING PARAMETER VALUES, STANDARD DIFFICULTIES, AND FACTOR LOADINGS

MATHEMATICAL KNOWLEDGE-FORM 1 ($N = 2760$)

Item	Attempts	Facility	Chance	Intercept	Principal Factors			Promax Factors		
					1	2	3	1	2	3
1	2758	0.640	0.1771	−0.1102	0.5607	−0.0801	0.0786	0.229	0.123	0.272
2	2754	0.899	0.3275	−1.0345	0.7170	0.1200	0.0170	0.683	−0.036	0.078
4	2722	0.382	0.1562	0.7738	0.9237	0.0171	−0.1710	0.912	0.253	−0.185
5	2738	0.327	0.0547	0.6909	0.8916	0.1009	0.0320	0.773	0.003	0.142
6	2751	0.820	0.0797	−0.8214	0.6197	−0.4929	−0.1772	0.006	0.792	0.024
8	2729	0.463	0.2177	0.6234	0.8798	0.0918	−0.0368	0.829	0.062	0.018
9	2750	0.801	0.4373	−0.3330	0.6830	0.0949	−0.0076	0.652	0.006	0.040
10	2754	0.855	0.1328	−0.9410	0.6308	−0.4671	−0.1535	0.022	0.747	0.056
11	2739	0.632	0.2695	0.0739	0.7007	0.0289	−0.0615	0.637	0.123	−0.022
12	2754	0.747	0.0432	−0.5560	0.6797	−0.2229	0.3744	−0.203	0.089	0.911
13	2737	0.327	0.1297	0.9364	0.9234	0.1962	−0.1107	1.084	0.004	−0.167
14	2742	0.647	0.3597	0.2304	0.8251	0.0569	0.0814	0.609	0.007	0.246
15	2754	0.740	0.2635	−0.3435	0.7362	0.1511	0.0381	0.716	−0.084	0.104
16	2749	0.578	0.0870	−0.0446	0.6084	0.0742	0.0824	0.467	−0.048	0.206
17	2746	0.715	0.2518	−0.2450	0.8490	0.1007	0.0236	0.750	0.003	0.120
18	2750	0.592	0.1220	−0.0223	0.7926	0.0590	0.0088	0.668	0.052	0.106
19	2738	0.353	0.1186	0.7620	0.9145	−0.0464	−0.1509	0.797	0.309	−0.116
20	2744	0.362	0.0728	0.5892	0.7672	0.0424	0.0548	0.575	0.033	0.196
21	2758	0.769	0.1895	−0.5420	0.5950	0.0798	−0.0054	0.562	0.007	0.039
22	2752	0.710	0.1524	−0.3521	0.7151	−0.1015	0.0749	0.321	0.175	0.300
24	2741	0.409	0.1677	0.7160	0.9359	0.1381	−0.1013	1.005	0.065	−0.117
25	2754	0.324	0.0677	0.6937	0.7723	0.0344	0.0163	0.611	0.072	0.129
26	2745	0.548	0.0640	0.0284	0.7232	−0.0753	0.1116	0.321	0.119	0.355
27	2739	0.455	0.1218	0.4221	0.8614	0.0882	0.0817	0.678	−0.024	0.236
28	2749	0.699	0.2337	−0.2220	0.7123	0.0924	0.0617	0.593	−0.038	0.174
29	2749	0.841	0.0860	−0.9025	0.6653	−0.2502	0.4636	−0.350	0.052	1.088
30	2749	0.852	0.0744	−0.9590	0.5711	−0.2399	0.0078	0.101	0.359	0.226
31	2730	0.404	0.1645	0.7105	0.9247	0.0187	−0.1592	0.901	0.242	−0.163
32	2726	0.391	0.0564	0.4883	0.9158	0.1518	−0.0262	0.924	−0.009	0.012
34	2748	0.430	0.0392	0.2901	0.5522	−0.2048	−0.0004	0.143	0.322	0.190
36	2734	0.722	0.4162	0.0033	0.6474	0.0199	−0.0046	0.521	0.084	0.080
37	2738	0.343	0.0956	0.7393	0.9167	0.0426	−0.1662	0.935	0.219	−0.190
38	2712	0.353	0.1162	0.7841	0.9279	0.0446	−0.1895	0.972	0.235	−0.232
39	2725	0.627	0.1650	−0.0635	0.7701	0.1106	0.0140	0.714	−0.014	0.085
40	2731	0.468	0.0739	0.2748	0.9085	0.0966	0.1246	0.677	−0.057	0.318
41	2736	0.806	0.0639	−0.7765	0.6277	−0.3593	−0.1029	0.108	0.586	0.093
42	2728	0.375	0.1224	0.7336	0.9304	−0.0403	−0.1912	0.862	0.334	−0.191
43	2716	0.574	0.1606	0.1110	0.8283	0.0881	0.0464	0.692	−0.003	0.166
44	2705	0.515	0.2438	0.4583	0.7830	0.0148	0.2823	0.296	−0.099	0.633
45	2724	0.736	0.0531	−0.5463	0.4563	−0.3189	−0.0471	−0.030	0.472	0.148
46	2693	0.769	0.1339	−0.5916	0.6371	0.0502	0.0608	0.481	−0.001	0.183

Adding Factor	Chi-square* Change	d.f.	p	Percent of Variance				Factor Correlations		
				1	2	3		1	2	3
2	631.125	40	<.001	59.1736	2.8319	1.9144	1	1.000		
3	259.593	39	<.001				2	0.648	1.000	
							3	0.841	0.660	1.000

*Assumed design effect = 2.

TABLE 21

ASVAB
ITEM ATTEMPTS, FACILITIES, GUESSING PARAMETER VALUES, STANDARD DIFFICULTIES, AND FACTOR LOADINGS
MATHEMATICAL KNOWLEDGE-FORM 3 ($N = 2665$)

Item	Attempts	Facility	Chance	Intercept	Principal Factors 1	Principal Factors 2	Principal Factors 3	Promax Factors 1	Promax Factors 2	Promax Factors 3
1	2652	0.850	0.2840	−0.8337	0.6979	0.0250	0.0217	0.427	0.258	0.059
2	2661	0.625	0.1523	−0.1438	0.7276	−0.0980	−0.0715	0.201	0.558	0.008
3	2653	0.430	0.0702	0.3165	0.8461	−0.0164	−0.0595	0.400	0.501	−0.017
4	2662	0.561	0.0616	−0.0914	0.8896	0.1688	0.0383	0.768	0.156	0.009
5	2653	0.232	0.1054	1.1405	0.8861	−0.0711	−0.0740	0.328	0.605	−0.001
6	2656	0.613	0.1775	−0.0701	0.7636	−0.0424	−0.1842	0.251	0.690	−0.176
7	2658	0.469	0.1369	0.3281	0.8253	0.0418	0.0066	0.515	0.321	0.037
8	2645	0.410	0.1034	0.4560	0.8603	0.1595	0.0338	0.735	0.161	0.006
9	2641	0.346	0.0893	0.6349	0.8614	0.1154	0.0257	0.661	0.224	0.022
10	2640	0.381	0.2193	0.8855	0.8236	0.0687	0.0018	0.554	0.297	0.014
11	2657	0.166	0.0898	1.4893	0.8424	−0.1417	−0.1705	0.143	0.817	−0.094
12	2652	0.637	0.2047	−0.1011	0.6822	−0.0593	0.0153	0.281	0.356	0.100
13	2656	0.486	0.0974	0.1814	0.7300	0.2697	0.1260	0.886	−0.170	0.058
14	2650	0.642	0.2600	−0.0274	0.8553	0.1052	0.1175	0.688	0.088	0.152
15	2656	0.799	0.1420	−0.7459	0.6548	−0.1041	0.0400	0.208	0.356	0.158
16	2653	0.738	0.0712	−0.5922	0.6530	−0.0831	−0.1036	0.168	0.558	−0.050
17	2660	0.913	0.1376	−1.3057	0.5535	−0.1871	−0.1334	−0.066	0.678	−0.035
18	2637	0.477	0.1602	0.3657	0.8717	0.0642	0.0089	0.577	0.313	0.030
19	2636	0.448	0.0957	0.3222	0.8819	0.1930	0.0692	0.818	0.076	0.036
20	2664	0.890	0.1424	−1.1737	0.6161	−0.1915	0.0230	0.039	0.464	0.185
21	2648	0.717	0.3871	−0.0852	0.8842	0.1254	0.0221	0.688	0.229	0.012
22	2660	0.889	0.1514	−1.1488	0.5094	−0.1580	−0.1292	−0.042	0.618	−0.049
23	2652	0.339	0.2211	1.0599	0.6110	−0.4043	−0.0366	−0.332	0.797	0.230
24	2651	0.332	0.1126	0.7381	0.8715	0.1653	−0.0543	0.706	0.298	−0.116
25	2651	0.319	0.1128	0.7568	0.7743	−0.1577	−0.1571	0.088	0.783	−0.070
27	2657	0.674	0.1504	−0.3218	0.8415	0.0522	−0.0009	0.536	0.329	0.022
28	2646	0.164	0.1128	1.6886	0.7999	−0.2819	−0.2188	−0.127	1.033	−0.079
30	2649	0.694	0.4484	0.1661	0.8237	0.0892	0.0269	0.600	0.235	0.036
31	2653	0.755	0.1535	−0.5707	0.7142	−0.1423	−0.0878	0.115	0.628	0.011
32	2652	0.452	0.3202	0.9771	0.8876	0.3139	−0.0232	0.966	0.088	−0.161
33	2657	0.732	0.0567	−0.5294	0.6274	−0.4053	0.4876	−0.060	−0.023	0.945
34	2639	0.632	0.1644	−0.1518	0.8629	0.0900	0.0387	0.628	0.233	0.054
35	2656	0.880	0.1560	−1.1097	0.6421	−0.1204	−0.1586	0.075	0.682	−0.103
36	2651	0.798	0.0936	−0.7857	0.6250	−0.2684	−0.0417	−0.111	0.657	0.143
37	2646	0.714	0.0847	−0.4925	0.5903	−0.2258	−0.0130	−0.047	0.548	0.155
38	2637	0.402	0.1505	0.5775	0.8703	0.2781	0.0863	0.955	−0.052	0.008
39	2624	0.337	0.0713	0.5949	0.6475	0.0135	−0.0248	0.358	0.321	−0.000
40	2629	0.450	0.1751	0.4978	0.8793	0.0651	−0.0023	0.577	0.333	0.015
41	2632	0.620	0.0897	−0.2084	0.7488	0.0642	0.0531	0.533	0.187	0.082
42	2627	0.703	0.1424	−0.3923	0.4875	−0.0628	−0.0547	0.135	0.382	−0.006
43	2623	0.482	0.1331	0.2765	0.7772	0.0834	0.0006	0.552	0.261	0.001
44	2639	0.706	0.2219	−0.3126	0.5253	−0.1030	−0.0163	0.111	0.384	0.073
45	2602	0.483	0.2023	0.4278	0.8646	0.2837	0.0941	0.965	−0.074	0.015
46	2596	0.788	0.0855	−0.7311	0.6384	−0.3519	0.4724	0.023	−0.055	0.894

Adding Factor	Chi-square* Change	d.f.	p	Percent of Variance 1	Percent of Variance 2	Percent of Variance 3		Factor Correlations 1	Factor Correlations 2	Factor Correlations 3
2	440.532	43	<.001	57.7802	3.2183	1.7316	1	1.000		
3	187.841	42	<.001				2	0.820	1.000	
							3	0.638	0.738	1.000

*Assumed design effect = 2.

TABLE 22

ASVAB

ITEM ATTEMPTS, FACILITIES, GUESSING PARAMETER VALUES, STANDARD DIFFICULTIES, AND FACTOR LOADINGS

MATHEMATICAL KNOWLEDGE-FORM 5 (N = 2468)

Item	Attempts	Facility	Chance	Intercept	Principal Factors			Promax Factors		
					1	2	3	1	2	3
1	2462	0.361	0.2431	1.1101	0.8564	−0.0911	−0.0315	0.241	0.540	0.139
2	2441	0.236	0.1390	1.3166	0.7717	0.0447	0.1104	0.533	0.270	0.018
3	2461	0.439	0.1377	0.4492	0.7996	0.0384	0.0217	0.433	0.282	0.147
4	2465	0.788	0.0627	−0.7386	0.7248	−0.3909	−0.0578	−0.210	1.036	−0.069
5	2464	0.740	0.1492	−0.4779	0.5026	−0.0384	−0.2111	−0.068	0.264	0.371
6	2464	0.682	0.1082	−0.3411	0.8715	−0.0465	0.1235	0.484	0.484	−0.049
7	2443	0.461	0.2194	0.5535	0.6037	0.0126	0.0240	0.316	0.244	0.088
8	2463	0.448	0.1225	0.2377	0.8700	0.2456	−0.2854	0.351	−0.111	0.757
9	2463	0.836	0.0852	−0.9073	0.6729	−0.3560	−0.0887	−0.228	0.944	−0.009
10	2461	0.866	0.1924	−0.9426	0.5652	−0.1542	−0.0989	−0.046	0.521	0.135
11	2442	0.359	0.1373	0.7550	0.8817	0.2191	0.0770	0.753	−0.010	0.216
12	2445	0.472	0.2347	0.5738	0.8287	0.1466	0.1696	0.751	0.113	0.019
13	2442	0.303	0.1320	0.9342	0.8053	−0.0183	0.0823	0.439	0.398	0.019
14	2450	0.597	0.1133	−0.0696	0.7390	−0.0231	0.1548	0.489	0.387	−0.102
15	2439	0.400	0.0589	0.4027	0.8885	0.1776	0.0955	0.728	0.072	0.160
16	2461	0.756	0.2014	−0.4826	0.5358	−0.1654	−0.0132	0.028	0.540	−0.003
17	2457	0.488	0.1591	0.3396	0.8063	−0.1031	−0.0091	0.230	0.544	0.088
18	2462	0.638	0.3114	0.0757	0.8256	0.2585	−0.3309	0.293	−0.161	0.824
19	2444	0.525	0.1370	0.1892	0.8644	0.0072	0.1271	0.549	0.382	−0.016
20	2463	0.873	0.1171	−1.0326	0.6135	0.0386	−0.3323	−0.069	0.154	0.624
21	2460	0.392	0.0766	0.4652	0.7316	−0.2222	0.0272	0.096	0.737	−0.066
22	2459	0.635	0.2308	−0.0077	0.8325	−0.1164	0.0297	0.272	0.585	0.027
23	2435	0.263	0.0948	0.9944	0.8670	−0.2254	−0.0050	0.115	0.798	0.003
24	2446	0.435	0.1910	0.5970	0.8829	0.2402	0.1066	0.814	−0.045	0.189
26	2455	0.461	0.1338	0.3910	0.8497	−0.0921	0.0958	0.387	0.556	−0.047
27	2464	0.844	0.1273	−0.8965	0.4007	−0.0785	−0.1577	−0.099	0.301	0.245
28	2445	0.294	0.1851	1.2001	0.8966	−0.0913	0.0219	0.322	0.565	0.069
29	2451	0.473	0.2062	0.4955	0.7999	0.2313	0.0445	0.692	−0.073	0.257
30	2452	0.652	0.1293	−0.1960	0.8135	0.1002	−0.0247	0.459	0.167	0.262
31	2447	0.386	0.0586	0.4691	0.8975	−0.0962	0.0751	0.379	0.582	−0.011
33	2440	0.260	0.0788	1.0331	0.9274	0.1831	0.1366	0.800	0.084	0.112
34	2447	0.917	0.2440	−1.1866	0.7528	0.1521	−0.1181	0.383	0.032	0.424
35	2423	0.472	0.2322	0.5513	0.8979	0.2640	0.0249	0.752	−0.093	0.328
36	2450	0.787	0.1393	−0.6371	0.6405	0.0161	−0.2305	0.037	0.221	0.465
38	2439	0.580	0.2420	0.2074	0.8689	−0.0209	0.0141	0.384	0.421	0.127
39	2455	0.653	0.1749	−0.1684	0.6215	−0.1609	0.0560	0.154	0.578	−0.083
40	2420	0.424	0.1487	0.5517	0.8659	−0.1052	−0.0332	0.226	0.571	0.133
41	2451	0.358	0.1052	0.6176	0.5811	−0.0180	0.1190	0.382	0.304	−0.076
42	2450	0.829	0.1540	−0.8070	0.5310	−0.0195	−0.0042	0.212	0.268	0.091
43	2417	0.418	0.2779	0.9599	0.8734	0.0067	0.0696	0.485	0.379	0.068
44	2450	0.787	0.1530	−0.6470	0.3504	0.0227	−0.1460	0.013	0.093	0.294
45	2445	0.744	0.0939	−0.5492	0.6295	−0.1778	−0.0648	−0.006	0.598	0.080

Adding Factor	Chi-square* Change	d.f.	p	Percent of Variance				Factor Correlations		
				1	2	3		1	2	3
2	399.522	41	<.001	58.5207	2.5036	1.6155	1	1.000		
3	173.498	40	<.001				2	0.805	1.000	
							3	0.720	0.774	1.000

*Assumed design effect = 2.

TABLE 23

ASVAB

ITEM ATTEMPTS, FACILITIES, GUESSING PARAMETER VALUES, STANDARD DIFFICULTIES, AND FACTOR LOADINGS

MECHANICAL COMPREHENSION-FORM 1 (N = 2731)

Item	Attempts	Facility	Chance	Intercept	Principal Factors 1	Principal Factors 2	Promax Factors 1	Promax Factors 2
1	2730	0.885	0.1698	−1.0968	0.5110	−0.1317	0.539	−0.013
2	2728	0.440	0.2956	0.8252	0.4468	−0.1041	0.451	0.009
3	2723	0.429	0.1124	0.3852	0.7232	0.1041	0.224	0.529
5	2725	0.788	0.1549	−0.6714	0.6331	−0.0116	0.387	0.269
6	2729	0.429	0.1210	0.3920	0.6724	−0.1381	0.644	0.049
7	2731	0.689	0.2803	−0.1643	0.6980	0.0108	0.383	0.341
8	2729	0.154	0.0651	1.3038	0.6781	−0.1358	0.643	0.056
9	2725	0.410	0.0933	0.4010	0.7264	−0.1405	0.679	0.069
10	2729	0.840	0.2690	−0.7787	0.5225	0.0191	0.266	0.276
11	2725	0.663	0.2460	−0.1219	0.6651	0.1224	0.157	0.537
13	2725	0.343	0.1434	0.7318	0.5933	−0.1306	0.584	0.027
14	2724	0.369	0.1584	0.6928	0.7646	0.1752	0.117	0.682
15	2725	0.527	0.1781	0.2055	0.6936	−0.0164	0.431	0.288
16	2729	0.437	0.2120	0.5818	0.6853	−0.0384	0.467	0.243
17	2724	0.374	0.1230	0.5707	0.6505	−0.2311	0.804	−0.136
18	2729	0.748	0.1480	−0.5360	0.6370	0.0309	0.310	0.351
19	2728	0.538	0.3262	0.5007	0.6669	0.0440	0.303	0.390
20	2727	0.339	0.1627	0.8091	0.7534	−0.1543	0.721	0.056
21	2716	0.432	0.2033	0.5823	0.7525	−0.0300	0.490	0.290
22	2719	0.821	0.1812	−0.7722	0.5443	−0.0210	0.353	0.211
23	2728	0.903	0.2199	−1.1641	0.5079	0.0542	0.193	0.336
24	2728	0.607	0.1434	−0.1035	0.4749	−0.0375	0.344	0.148
25	2721	0.653	0.0917	−0.2890	0.6758	0.2023	0.015	0.692
26	2724	0.749	0.2168	−0.4634	0.5959	0.1126	0.135	0.487
28	2724	0.513	0.1657	0.2234	0.6200	0.0287	0.305	0.339
29	2722	0.662	0.0492	−0.3639	0.6229	0.4076	−0.396	1.055
30	2719	0.402	0.3312	1.2888	0.8333	−0.2374	0.921	−0.064
31	2720	0.385	0.1728	0.6639	0.6937	−0.1195	0.622	0.094
32	2720	0.212	0.0813	1.0665	0.7746	−0.1848	0.789	0.008
33	2719	0.740	0.1211	−0.5329	0.4857	0.0546	0.179	0.326
34	2713	0.386	0.1654	0.6432	0.7264	−0.1620	0.719	0.029
35	2716	0.915	0.1606	−1.2792	0.5204	0.0497	0.208	0.333
36	2712	0.581	0.0873	−0.0773	0.8149	−0.0531	0.569	0.275
37	2711	0.807	0.2218	−0.6740	0.6482	0.0494	0.283	0.391
38	2699	0.464	0.3218	0.8308	0.7621	0.1014	0.252	0.542
39	2708	0.519	0.1503	0.1840	0.6571	0.1579	0.087	0.600
40	2701	0.533	0.1083	0.0765	0.6527	−0.0109	0.397	0.280
41	2694	0.769	0.1171	−0.6324	0.6366	0.2443	−0.085	0.753
42	2695	0.891	0.1584	−1.1323	0.5068	0.1166	0.077	0.453
44	2682	0.623	0.4003	0.3575	0.6928	0.0470	0.313	0.407
45	2661	0.754	0.1204	−0.5756	0.5368	−0.0516	0.406	0.150
46	2650	0.846	0.1380	−0.9220	0.6240	0.1418	0.097	0.554

Adding Factor	Chi-square* Change	d.f.	p	Percent of Variance 1	Percent of Variance 2		Factor Correlations 1	Factor Correlations 2
2	130.207	41	<.001	42.4706	1.7690	1	1.000	
3	102.184	40	<.001			2	0.857	1.000

*Assumed design effect = 2.

TABLE 24

ASVAB
ITEM ATTEMPTS, FACILITIES, GUESSING PARAMETER VALUES, STANDARD DIFFICULTIES, AND FACTOR LOADINGS
MECHANICAL COMPREHENSION-FORM 3 (N = 2647)

Item	Attempts	Facility	Chance	Intercept	Principal Factors 1	Principal Factors 2	Promax Factors 1	Promax Factors 2
1	2640	0.332	0.2141	1.0881	0.8181	0.0227	0.788	0 042
3	2643	0.835	0.1695	−0.8348	0.3685	−0.0553	0.284	0.112
4	2644	0.536	0.1067	0.0671	0.5769	0.0580	0.601	−0.030
5	2642	0.751	0.1499	−0.5327	0.5034	0.1029	0.581	−0.101
7	2643	0.544	0.2204	0.2459	0.7148	0.0864	0.760	−0.058
8	2644	0.505	0.1039	0.1627	0.7289	0.0527	0.737	−0.009
9	2647	0.436	0.1661	0.4778	0.5608	0.0251	0.551	0.015
10	2646	0.848	0.1347	−0.9288	0.6637	−0.0010	0.619	0.062
11	2633	0.295	0.2254	1.3950	0.8351	0.0712	0.856	−0.026
12	2646	0.907	0.1620	−1.2189	0.4377	0.0143	0.424	0.019
13	2642	0.205	0.1484	1.5356	0.8464	0.0210	0.813	0.047
15	2635	0.327	0.1632	0.8884	0.6250	−0.0325	0.548	0.103
16	2645	0.607	0.3880	0.3930	0.5981	0.0232	0.583	0.021
17	2639	0.288	0.0682	0.7593	0.7862	0.0303	0.767	0.028
18	2643	0.454	0.1119	0.3066	0.4944	0.0100	0.472	0.031
19	2641	0.421	0.1678	0.5580	0.8091	0.0446	0.803	0.010
20	2634	0.274	0.0637	0.7947	0.6976	0.0298	0.683	0.021
21	2644	0.529	0.2395	0.3451	0.8190	0.1061	0.879	−0.077
22	2641	0.638	0.1342	−0.1886	0.6062	0.0459	0.615	−0.010
24	2640	0.438	0.3783	1.3686	0.8114	0.0170	0.776	0.049
25	2644	0.507	0.1931	0.3113	0.6805	−0.0048	0.630	0.069
26	2642	0.708	0.3502	−0.1153	0.3729	0.0348	0.386	−0.016
27	2635	0.567	0 1013	−0.0112	0.7312	−0.0376	0.642	0.120
28	2631	0.594	0 1767	0.0137	0.6692	0.0072	0.632	0 050
30	2629	0 566	0.1832	0.1043	0.6102	0.0568	0.631	−0.026
31	2621	0.280	0.1988	1.3322	0.8261	0.1489	0.931	−0.137
32	2634	0.600	0.3165	0.2539	0.7315	0.0751	0.764	−0.041
34	2632	0.899	0.1287	−1.1928	0.6241	−0.1399	0.432	0.255
35	2630	0.450	0.1286	0.3746	0.7572	0.0590	0.770	−0.015
36	2627	0.784	0.1951	−0.6017	0.5755	−0.0869	0.444	0 176
37	2619	0.826	0.2436	−0.7213	0.6915	−0.1347	0.501	0.254
38	2618	0.469	0.3551	0.9828	0.7911	0.1386	0.888	−0.125
39	2614	0.609	0 1229	−0.1128	0.5494	−0.0730	0.434	0.154
40	2613	0.770	0.1879	−0.5243	0.5318	−0.6842	−0.240	1.021
41	2589	0.466	0.2084	0.4951	0.6775	0.0351	0.670	0.011
42	2578	0.412	0.1549	0.5548	0.7140	0.0931	0.767	−0.068
43	2597	0.850	0.1451	−0.9181	0.5665	−0.5792	−0.095	0.875
44	2575	0.531	0 1159	0.1342	0.8387	0.0079	0.791	0.065
45	2560	0.594	0.2294	0.1028	0.6686	0.0447	0.672	−0.003
46	2517	0.760	0.1927	−0.5064	0.6169	−0.0107	0.564	0.071

Adding Factor	Chi-square* Change	d.f.	p	Percent of Variance 1	Percent of Variance 2		Factor Correlations 1	Factor Correlations 2
2	160.687	39	<.001	45.5521	2.4397	1	1.000	
3	78.891	38	<.001			2	0.712	1.000

*Assumed design effect = 2.

TABLE 25

ASVAB

ITEM ATTEMPTS, FACILITIES, GUESSING PARAMETER VALUES, STANDARD DIFFICULTIES, AND FACTOR LOADINGS

MECHANICAL COMPREHENSION-FORM 5 (N = 2532)

Item	Attempts	Facility	Chance	Intercept	Principal Factors 1	Principal Factors 2	Promax Factors 1	Promax Factors 2
2	2530	0.674	0.1870	−0.2413	0.5172	−0.1866	−0.040	0.581
3	2527	0.708	0.1084	−0.4315	0.6077	−0.1707	0.029	0.608
4	2530	0.799	0.2133	−0.6490	0.7190	−0.2210	0.004	0.749
5	2526	0.516	0.1631	0.2243	0.7621	0.0151	0.397	0.407
7	2531	0.889	0.2091	−1.0767	0.2501	0.0244	0.161	0.103
8	2531	0.421	0.3105	1.0279	0.7239	0.0881	0.494	0.272
9	2531	0.668	0.1736	−0.2326	0.6452	−0.0807	0.189	0.490
10	2528	0.672	0.2415	−0.1534	0.5888	−0.1497	0.053	0.565
11	2527	0.364	0.0605	0.4754	0.5882	−0.0849	0.154	0.464
12	2523	0.423	0.1147	0.4153	0.6967	−0.0723	0.228	0.506
14	2512	0.400	0.1685	0.6225	0.7786	0.0024	0.385	0.436
16	2525	0.611	0.3593	0.2982	0.6473	0.1490	0.552	0.135
17	2519	0.397	0.1616	0.6050	0.7165	−0.0979	0.197	0.557
18	2524	0.543	0.2283	0.2619	0.7631	0.1581	0.623	0.186
19	2529	0.862	0.2329	−0.9113	0.6782	−0.1335	0.122	0.590
20	2531	0.879	0.2391	−0.9984	0.5974	−0.0858	0.158	0.471
21	2521	0.453	0.2289	0.5783	0.6895	−0.0134	0.317	0.410
22	2529	0.896	0.1148	−1.1812	0.6037	−0.0651	0.193	0.442
24	2523	0.480	0.1657	0.3241	0.3486	0.1021	0.332	0.039
26	2520	0.259	0.1644	1.2394	0.6737	0.2221	0.680	0.036
27	2530	0.915	0.1663	−1.2668	0.5099	−0.0063	0.240	0.298
28	2530	0.864	0.2244	−0.9267	0.3897	−0.0160	0.166	0.245
29	2526	0.297	0.1198	0.8431	0.4864	−0.1895	−0.060	0.569
30	2524	0.751	0.3186	−0.3273	0.5758	0.1041	0.446	0.164
31	2526	0.558	0.1247	0.0344	0.6983	0.0136	0.364	0.373
32	2527	0.752	0.2714	−0.3984	0.5189	0.1315	0.462	0.089
33	2506	0.453	0.0817	0.2608	0.5228	0.0223	0.291	0.261
34	2513	0.793	0.1694	−0.6538	0.7230	0.0567	0.444	0.320
35	2510	0.413	0.1096	0.4305	0.5483	−0.3449	−0.275	0.845
36	2511	0.282	0.1035	0.8718	0.7576	0.0821	0.501	0.301
37	2506	0.465	0.1778	0.4252	0.7985	−0.0505	0.312	0.529
38	2506	0.385	0.1456	0.6029	0.6355	−0.2653	−0.107	0.770
39	2508	0.674	0.1423	−0.2885	0.5670	−0.0973	0.125	0.471
40	2508	0.691	0.2243	−0.2365	0.6651	−0.0780	0.203	0.497
41	2505	0.886	0.1535	−1.0977	0.6368	0.2903	0.770	−0.090
42	2498	0.899	0.1815	−1.1477	0.6185	0.3431	0.844	−0.183
43	2490	0.800	0.3040	−0.5310	0.7387	0.2481	0.753	0.033
44	2474	0.694	0.2012	−0.2634	0.6711	−0.0147	0.306	0.402
45	2462	0.523	0.1566	0.2081	0.7734	0.1576	0.627	0.193
46	2441	0.798	0.0843	−0.7427	0.6489	0.0560	0.406	0.280

Adding Factor	Chi-square* Change	d.f.	p	Percent of Variance 1	Percent of Variance 2		Factor Correlations 1	Factor Correlations 2
2	122.820	39	<.001	40.7123	2.2075	1	1.000	
3	48.26	38	<.001			2	0.796	1.000

*Assumed design effect = 2.

TABLE 26

ASVAB
ITEM ATTEMPTS. FACILITIES. GUESSING PARAMETER VALUES. STANDARD DIFFICULTIES. AND FACTOR LOADINGS
ELECTRONICS INFORMATION-FORM 1 (N = 2910)

Item	Attempts	Facility	Chance	Intercept	Principal Factors
1	2907	0.375	0.0743	0.4628	0.5591
3	2891	0.135	0.0926	1.7291	0.7505
4	2902	0.694	0.1492	−0.3613	0.7121
8	2904	0.178	0.0894	1.3209	0.6122
9	2905	0.341	0.1320	0.7102	0.4038
11	2908	0.795	0.1705	−0.6871	0.4497
13	2901	0.629	0.2393	−0.0271	0.0510
14	2907	0.548	0.2735	0.3164	0.7168
17	2900	0.306	0.1092	0.7858	0.5648
18	2902	0.563	0.2367	0.1897	0.6616
19	2907	0.665	0.1311	−0.2892	0.4143
21	2901	0.531	0.1685	0.1706	0.6630
22	2901	0.418	0.0960	0.3838	0.8125
25	2904	0.586	0.2092	0.0625	0.4750
26	2906	0.742	0.1414	−0.5205	0.3449
27	2908	0.793	0.2114	−0.6354	0.3596
28	2904	0.431	0.0896	0.3252	0.5693
29	2901	0.724	0.1236	−0.4777	0.4599
30	2909	0.853	0.2420	−0.8737	0.5715
31	2905	0.156	0.0841	1.4829	0.7364
33	2902	0.330	0.0831	0.6267	0.5614
34	2907	0.683	0.2443	−0.2030	0.6709
35	2907	0.822	0.4829	−0.4028	0.6505
36	2905	0.915	0.2265	−1.2297	0.3862
38	2900	0.832	0.2695	−0.7392	0.5709
39	2899	0.749	0.2627	−0.4139	0.7085
40	2896	0.421	0.1843	0.5781	0.8540
41	2904	0.412	0.1543	0.5144	0.1609
42	2897	0.546	0.1282	0.0600	0.5311
44	2894	0.591	0.3426	0.3354	0.7797
45	2900	0.501	0.1622	0.2543	0.7444
46	2894	0.339	0.2688	1.3316	0.4403
47	2887	0.632	0.1100	−0.2077	0.3958
48	2888	0.484	0.1129	0.2128	0.2218
49	2903	0.890	0.1513	−1.1315	0.4572
50	2890	0.327	0.2031	1.0431	0.8274
53	2894	0.466	0.2252	0.5136	0.7337
54	2892	0.525	0.3026	0.5057	0.7384
55	2896	0.572	0.1013	−0.0569	0.4712
56	2893	0.862	0.1128	−1.0194	0.5747
57	2871	0.773	0.3244	−0.4246	0.7761
Adding Factor	Chi-square* Change	d.f.	p		Percent of Variance
2	196.752	40	<.001		35.2255

*Assumed design effect = 2.

TABLE 27

ASVAB

ITEM ATTEMPTS FACILITIES, GUESSING PARAMETER VALUES, STANDARD DIFFICULTIES, AND FACTOR LOADINGS

ELECTRONIC INFORMATION-FORM 2 (N = 2765)

Item	Attempts	Facility	Chance	Intercept	Principal Factor
1	2761	0.332	0.0785	0.5998	0.7399
3	2764	0.884	0.2876	−0.9999	0.5655
5	2763	0.392	0.2536	0.8974	0.3339
6	2761	0.453	0.3211	0.8905	0.8032
7	2761	0.277	0.0993	0.8595	0.7295
8	2762	0.760	0.2418	−0.4850	0.4922
9	2758	0.363	0.2048	0.8579	0.6785
11	2764	0.489	0.2381	0.4407	0.2627
12	2758	0.567	0.1395	0.0050	0.6389
13	2764	0.725	0.1189	−0.4963	0.5086
15	2761	0.481	0.1376	0.2555	0.4360
16	2752	0.529	0.3711	0.6924	0.6820
18	2763	0.899	0.1157	−1.2214	0.7011
19	2758	0.348	0.1004	0.6001	0.7182
20	2757	0.362	0.2137	0.8985	0.6800
21	2761	0.213	0.0935	1.1274	0.7237
22	2765	0.780	0.2164	−0.5887	0.4334
23	2765	0.725	0.2025	−0.4081	0.5262
24	2760	0.387	0.0881	0.4455	0.6535
26	2763	0.808	0.1297	−0.7752	0.3619
28	2762	0.677	0.2142	−0.2295	0.3744
29	2764	0.811	0.1195	−0.8046	0.6651
30	2755	0.237	0.0747	0.9390	0.6826
31	2765	0.590	0.1407	−0.0658	0.5867
32	2763	0.860	0.2018	−0.9461	0.6428
33	2760	0.648	0.2394	−0.0978	0.6021
37	2760	0.509	0.1155	0.1365	0.5647
39	2761	0.761	0.3987	−0.2608	0.5569
40	2763	0.850	0.3455	−0.7524	0.5887
42	2759	.0.362	0.0844	0.5137	0.8637
44	2762	0.525	0.2049	0.2428	0.6250
45	2761	0.774	0.2308	−0.5417	0.2303
46	2759	0.479	0.3485	0.8670	0.6035
47	2744	0.271	0.1719	1.2004	0.7224
48	2759	0.409	0.1024	0.4095	0.6910
49	2758	0.584	0.3096	0.2546	0.8586
50	2751	0.334	0.2132	1.0426	0.8113
51	2753	0.785	0.1466	−0.6728	0.4883
53	2753	0.901	0.1706	−1.1899	0.5288
54	2750	0.886	0.1941	−1.0781	0.5175
55	2751	0.688	0.2476	−0.2170	0.5546
57	2711	0.529	0.3490	0.6117	0.7661
Adding Factor	Chi-square* Change	d.f.	p		Percent of Variance
2	194.400	41	<.001		38.1883

* Assumed design effect = 2.

TABLE 28

ASVAB
ITEM ATTEMPTS, FACILITIES, GUESSING PARAMETER VALUES
STANDARD DIFFICULTIES, AND FACTOR LOADINGS
ELECTRONICS INFORMATION-FORM 3 (N = 2692)

Item	Attempts	Facility	Chance	Intercept	Principal Factors
1	2684	0.331	0.1827	0.9729	0.8180
2	2684	0.761	0.2266	−0.4927	0.2699
3	2685	0.581	0.4726	0.8905	0.8177
6	2686	0.588	0.3212	0.2855	0.6245
7	2688	0.459	0.2092	0.5065	0.8241
8	2687	0.837	0.2604	−0.7718	0.4576
9	2683	0.846	0.2755	−0.8117	0.7257
10	2688	0.555	0.4328	0.8399	0.7739
11	2688	0.453	0.3671	1.1649	0.6389
12	2690	0.737	0.2804	−0.3454	0.4709
13	2689	0.523	0.1334	0.1330	0.5276
14	2690	0.851	0.2025	−0.9162	0.8403
15	2690	0.277	0.1035	0.8918	0.6046
16	2687	0.675	0.1148	−0.3466	0.7005
17	2680	0.451	0.2931	0.7765	0.4460
18	2687	0.527	0.2623	0.3765	0.6156
19	2684	0.363	0.0908	0.5563	0.8512
20	2684	0.745	0.2142	−0.4573	0.5676
21	2679	0.462	0.2860	0.7363	0.7938
22	2683	0.687	0.2701	−0.1747	0.5849
23	2685	0.441	0.1608	0.4428	0.6341
24	2674	0.841	0.2669	−0.7799	0.6045
25	2683	0.735	0.3347	−0.2549	0.6611
28	2687	0.735	0.1683	−0.4711	0.3649
29	2684	0.440	0.1632	0.4480	0.5069
30	2689	0.895	0.3262	−1.0355	0.7366
31	2683	0.867	0.5000	−0.6192	−0.0104
32	2688	0.476	0.2285	0.4872	0.6444
33	2686	0.643	0.1312	−0.2256	0.6238
34	2685	0.462	0.3996	1.3419	0.7833
35	2681	0.636	0.2880	0.0350	0.2646
36	2675	0.195	0.1126	1.3627	0.5047
37	2679	0.337	0.1528	0.8119	0.5777
38	2687	0.733	0.4400	−0.0487	0.5186
40	2688	0.649	0.1615	−0.2067	0.6630
41	2682	0.483	0.2098	0.4269	0.8346
42	2688	0.869	0.1462	−1.0325	0.5375
44	2685	0.371	0.1640	0.6991	0.5010
45	2676	0.356	0.2214	0.9841	0.7209
46	2690	0.888	0.3298	−0.9850	0.5709
48	2681	0.772	0.3944	−0.3129	0.5993
49	2690	0.864	0.1962	−0.9831	0.6697
50	2688	0.866	0.2715	−0.9223	0.7110
52	2679	0.591	0.1916	0.0236	0.6418
53	2680	0.524	0.2381	0.3293	0.5209
54	2681	0.807	0.2837	−0.6167	0.4746
56	2678	0.687	0.1172	−0.3735	0.5308
57	2632	0.215	0.1394	1.4132	0.7148
Adding Factor	Chi-square* Change	d.f.	p		Percent of Variance
2	249.824	47	<.001		39.3769

*Assumed design effect = 2

Dr. Terry Ackerman
American College Testing Programs
P.O. Box 168
Iowa City, IA 52243

Dr. Erling B. Andersen
Department of Statistics
Studiestraede 6
1455 Copenhagen
DENMARK

Dr. Menucha Birenbaum
School of Education
Tel Aviv University
Tel Aviv, Ramat Aviv 69978
ISRAEL

Dr. Bruce Bloxom
Defense Manpower Data Center
550 Camino El Estero,
Suite 200
Monterey, CA 93943-3231

Cdt. Arnold Bohrer
Sectie Psychologisch Onderzoek
Rekruterings-En Selectiecentrum
Kwartier Koningen Astrid
Bruijnstraat
1120 Brussels, BELGIUM

Dr. Robert Brennan
American College Testing
Programs
P. O. Box 168
Iowa City, IA 52243

Dr. James Carlson
American College Testing
Program
P.O. Box 168
Iowa City, IA 52243

Dr. John B. Carroll
409 Elliott Rd.
Chapel Hill, NC 27514

Dr. Robert Carroll
OP 01B7
Washington, DC 20370

Dr. Norman Cliff
Department of Psychology
Univ. of So. California
University Park
Los Angeles, CA 90007

Director,
Manpower Support and
Readiness Program
Center for Naval Analysis
2000 North Beauregard Street
Alexandria, VA 22311

Dr. Stanley Collyer
Office of Naval Technology
Code 222
800 N. Quincy Street
Arlington, VA 22217-5000

Dr. Hans Crombag
University of Leyden
Education Research Center
Boerhaavelaan 2
2334 EN Leyden
The NETHERLANDS

Mr. Timothy Davey
University of Illinois
Educational Psychology
Urbana, IL 61801

Dr. Dattprasad Divgi
Center for Naval Analysis
4401 Ford Avenue
P.O. Box 16268
Alexandria, VA 22302-0268

Dr. Hei-Ki Dong
Bell Communications Research
6 Corporate Place
PYA-1k226
Piscataway, NJ 08854

Dr. Fritz Drasgow
University of Illinois
Department of Psychology
603 E. Daniel St.
Champaign, IL 61820

1987/07/01

National Opinion Research Center/Bock

Defense Technical
Information Center
Cameron Station, Bldg 5
Alexandria, VA 22314
Attn: TC
(12 Copies)

Dr. Stephen Dunbar
Lindquist Center
for Measurement
University of Iowa
Iowa City, IA 52242

Dr. James A. Earles
Air Force Human Resources Lab
Brooks AFB, TX 78235

Dr. Kent Eaton
Army Research Institute
5001 Eisenhower Avenue
Alexandria, VA 22333

Dr. Susan Embretson
University of Kansas
Psychology Department
426 Fraser
Lawrence, KS 66045

Dr. Benjamin A. Fairbank
Performance Metrics, Inc.
5825 Callaghan
Suite 225
San Antonio, TX 78228

Dr. Leonard Feldt
Lindquist Center
for Measurement
University of Iowa
Iowa City, IA 52242

Dr. Richard L. Ferguson
American College Testing
Program
P.O. Box 168
Iowa City, IA 52240

Dr. Gerhard Fischer
Liebiggasse 5/3
A 1010 Vienna
AUSTRIA

Dr. Myron Fischl
Army Research Institute
5001 Eisenhower Avenue
Alexandria, VA 22333

Prof. Donald Fitzgerald
University of New England
Department of Psychology
Armidale, New South Wales 2351
AUSTRALIA

Mr. Paul Foley
Navy Personnel R&D Center
San Diego, CA 92152-6800

Dr. Robert D. Gibbons
Illinois State Psychiatric Inst.
Rm 529W
1601 W. Taylor Street
Chicago, IL 60612

Dr. Janice Gifford
University of Massachusetts
School of Education
Amherst, MA 01003

Dr. Bert Green
Johns Hopkins University
Department of Psychology
Charles & 34th Street
Baltimore, MD 21218

Dipl. Pad. Michael W. Habon
Universitat Dusseldorf
Erziehungswissenschaftliches
Universitatsstr. 1
D-4000 Dusseldorf 1
WEST GERMANY

Dr. Ronald K. Hambleton
Prof. of Education & Psychology
University of Massachusetts
at Amherst
Hills House
Amherst, MA 01003

Ms. Rebecca Hetter
Navy Personnel R&D Center
Code 62
San Diego, CA 92152-6800

Dr. Paul W. Holland
Educational Testing Service
Rosedale Road
Princeton, NJ 08541

Prof. Lutz F. Hornke
Institut fur Psychologie
RWTH Aachen
Jaegerstrasse 17/19
D-5100 Aachen
WEST GERMANY

Dr. Paul Horst
677 G Street, #184
Chula Vista, CA 90010

Mr. Dick Hoshaw
OP-135
Arlington Annex
Room 2834
Washington, DC 20350

Dr. Lloyd Humphreys
University of Illinois
Department of Psychology
603 East Daniel Street
Champaign, IL 61820

Dr. Huynh Huynh
College of Education
Univ. of South Carolina
Columbia, SC 29208

Dr. Robert Jannarone
Department of Psychology
University of South Carolina
Columbia, SC 29208

Dr. Douglas H. Jones
Thatcher Jones Associates
P.O. Box 6640
10 Trafalgar Court
Lawrenceville, NJ 08648

Dr. G. Gage Kingsbury
Portland Public Schools
Research and Evaluation Department
501 North Dixon Street
P. O. Box 3107
Portland, OR 97209-3107

Dr. William Koch
University of Texas-Austin
Measurement and Evaluation
Center
Austin, TX 78703

Dr. James Kraatz
Computer-based Education
Research Laboratory
University of Illinois
Urbana, IL 61801

Dr. Leonard Kroeker
Navy Personnel R&D Center
San Diego, CA 92152-6800

Dr. Thomas Leonard
University of Wisconsin
Department of Statistics
1210 West Dayton Street
Madison, WI 53705

Dr. Michael Levine
Educational Psychology
210 Education Bldg.
University of Illinois
Champaign, IL 61801

Dr. Charles Lewis
Educational Testing Service
Princeton, NJ 08541

Dr. Robert Linn
College of Education
University of Illinois
Urbana, IL 61801

Dr. Robert Lockman
Center for Naval Analysis
4401 Ford Avenue
P.O. Box 16268
Alexandria, VA 22302-0268

Dr. Frederic M. Lord
Educational Testing Service
Princeton, NJ 08541

Dr. James Lumsden
Department of Psychology
University of Western Australia
Nedlands W.A. 6009
AUSTRALIA

Dr. Milton Maier
Center for Naval Analysis
4401 Ford Avenue
P.O. Box 16268
Alexandria, VA 22302-0268

Dr. William L. Maloy
Chief of Naval Education
and Training
Naval Air Station
Pensacola, FL 32508

Dr. Gary Marco
Stop 31-E
Educational Testing Service
Princeton, NJ 08451

Dr. Clessen Martin
Army Research Institute
5001 Eisenhower Blvd.
Alexandria, VA 22333

Dr. James McBride
Psychological Corporation
c/o Harcourt, Brace,
Javanovich Inc.
1250 West 6th Street
San Diego, CA 92101

Dr. Clarence McCormick
HQ, MEPCOM
MEPCT-P
2500 Green Bay Road
North Chicago, IL 60064

Dr. Robert McKinley
Educational Testing Service
20-P
Princeton, NJ 08541

Dr. James McMichael
Technical Director
Navy Personnel R&D Center
San Diego, CA 92152

Dr. Robert Mislevy
Educational Testing Service
Princeton, NJ 08541

Headquarters, Marine Corps
Code MPI-20
Washington, DC 20380

Dr. W. Alan Nicewander
University of Oklahoma
Department of Psychology
Oklahoma City, OK 73069

Library, NPRDC
Code P201L
San Diego, CA 92152-6800

Dr. James Olson
WICAT, Inc.
1875 South State Street
Orem, UT 84057

Office of Naval Research,
Code 1142PT
800 N. Quincy Street
Arlington, VA 22217-5000
(6 Copies)

Assistant for MPT Research,
Development and Studies
OP 01B7
Washington, DC 20370

Dr. Judith Orasanu
Army Research Institute
5001 Eisenhower Avenue
Alexandria, VA 22333

Dr. Jesse Orlansky
Institute for Defense Analyses
1801 N. Beauregard St.
Alexandria, VA 22311

Dr. Randolph Park
Army Research Institute
5001 Eisenhower Blvd.
Alexandria, VA 22333

Wayne M. Patience
American Council on Education
GED Testing Service, Suite 20
One Dupont Circle, NW
Washington, DC 20036

Dr. James Paulson
Department of Psychology
Portland State University
P.O. Box 751
Portland, OR 97207

Dr. Mark D. Reckase
ACT
P. O. Box 168
Iowa City, IA 52243

Dr. Malcolm Ree
AFHRL/MP
Brooks AFB, TX 78235

Dr. J. Ryan
Department of Education
University of South Carolina
Columbia, SC 29208

Dr. Fumiko Samejima
Department of Psychology
University of Tennessee
3108 AustinPeay Bldg.
Knoxville, TN 37916-0900

Mr. Drew Sands
NPRDC Code 62
San Diego, CA 92152-6800

Dr. Mary Schratz
Navy Personnel R&D Center
San Diego, CA 92152-6800

Dr. Dan Segall
Navy Personnel R&D Center
San Diego, CA 92152

Dr. W. Steve Sellman
OASD(MRA&L)
2B269 The Pentagon
Washington, DC 20301

Dr. Kazuo Shigemasu
7-9-24 Kugenuma-Kaigan
Fujusawa 251
JAPAN

Dr. William Sims
Center for Naval Analysis
4401 Ford Avenue
P.O. Box 16268
Alexandria, VA 22302-0268

Dr. Richard Sorensen
Navy Personnel R&D Center
San Diego, CA 92152-6800

Dr. Paul Speckman
University of Missouri
Department of Statistics
Columbia, MO 65201

Dr. Judy Spray
ACT
P.O. Box 168
Iowa City, IA 52243

Dr. Martha Stocking
Educational Testing Service
Princeton, NJ 08541

Dr. Peter Stoloff
Center for Naval Analysis
200 North Beauregard Street
Alexandria, VA 22311

Dr. William Stout
University of Illinois
Department of Statistics
101 Illini Hall
725 South Wright St.
Champaign, IL 61820

Maj. Bill Strickland
AF/MPXOA
4E168 Pentagon
Washington, DC 20330

Dr. Hariharan Swaminathan
Laboratory of Psychometric and
Evaluation Research
School of Education
University of Massachusetts
Amherst, MA 01003

Mr. Brad Sympson
Navy Personnel R&D Center
San Diego, CA 92152-6800

Dr. Kikumi Tatsuoka
CERL
252 Engineering Research
Laboratory
Urbana, IL 61801

Dr. Maurice Tatsuoka
220 Education Bldg
1310 S. Sixth St.
Champaign, IL 61820

Dr. David Thissen
Department of Psychology
University of Kansas
Lawrence, KS 66044

Mr. Gary Thomasson
University of Illinois
Educational Psychology
Champaign, IL 61820

Dr. Robert Tsutakawa
University of Missouri
Department of Statistics
222 Math. Sciences Bldg.
Columbia, MO 65211

Dr. Ledyard Tucker
University of Illinois
Department of Psychology
603 E. Daniel Street
Champaign, IL 61820

Dr. David Vale
Assessment Systems Corp.
2233 University Avenue
Suite 310
St. Paul, MN 55114

Dr. Howard Wainer
Division of Psychological Studies
Educational Testing Service
Princeton, NJ 08541

Dr. Ming-Mei Wang
Lindquist Center
for Measurement
University of Iowa
Iowa City, IA 52242

Dr. Thomas A. Warm
Coast Guard Institute
P. O. Substation 18
Oklahoma City, OK 73169

Dr. Brian Waters
Program Manager
Manpower Analysis Program
HumRRO
1100 S. Washington St.
Alexandria, VA 22314

Dr. David J. Weiss
N660 Elliott Hall
University of Minnesota
75 E. River Road
Minneapolis, MN 55455

Dr. Ronald A. Weitzman
NPS, Code 54Wz
Monterey, CA 92152-6800

Major John Welsh
AFHRL/MOAN
Brooks AFB, TX 78223

Dr. Rand R. Wilcox
University of Southern
California
Department of Psychology
Los Angeles, CA 90007

German Military Representative
ATTN: Wolfgang Wildegrube
Streitkraefteamt
D-5300 Bonn 2
4000 Brandywine Street, NW
Washington, DC 20016

Dr. Bruce Williams
Department of Educational
Psychology
University of Illinois
Urbana, IL 61801

Dr. Hilda Wing
Psychological Corporation
c/o Harcourt, Brace,
Javanovich Inc.
1250 West 6th Street
San Diego, CA 92101

Mr. John H. Wolfe
Navy Personnel R&D Center
San Diego, CA 92152-6800

Dr. George Wong
Biostatistics Laboratory
Memorial Sloan-Kettering
Cancer Center
1275 York Avenue
New York, NY 10021

Dr. Kentaro Yamamoto
Computer-based Education
Research Laboratory
University of Illinois
Urbana, IL 61801

Dr. Wendy Yen
CTB/McGraw Hill
Del Monte Research Park
Monterey, CA 93940

END

9-87

DTIC